



Installation, Start-Up, and Service Instructions

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IMPORTANT: Read the entire instruction manual before starting installation.

SAFETY CONSIDERATIONS


Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and electrical codes for special installation requirements.

Understand the signal words — DANGER, WARNING, and CAUTION. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards that could result in personal injury or death. CAUTION is used to identify unsafe practices, which would result in minor personal injury or product and property damage.

Recognize safety information. This is the safety-alert symbol () . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

WARNING

Electrical shock can cause personal injury or death. Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power if applicable.

GENERAL

This Installation and Start-Up Instructions literature is for Aquazone™ Water Source Heat Pump units bearing the Mark of The European Community (CE). These units are designed in accordance with European Standard EN60335-2-400.

Water Source Heat Pump (WSHP) units are single-package horizontal mounted units with electronic controls designed for year-round cooling and heating. Aquazone 50RHE WSHP units are designed for high-efficiency operation using HFC-407C refrigerant.

IMPORTANT: The installation of water source heat pump units and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

INSTALLATION

Step 1 — Check Jobsite — Installation, operation and maintenance instructions are provided with each unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check out the system before operation. Complete the inspections and instructions listed below to prepare a unit for installation. See Table 1 for unit physical data.

Horizontal units are designed for indoor installation only. Be sure to allow adequate space around the unit for servicing. See Fig. 1 for overall unit dimensions. Refer to Fig. 2 for an illustration of a typical horizontal installation.

CAUTION

To avoid equipment damage, do not use these units as a source of heating or cooling during the construction process. The mechanical components and filters used in these units quickly become clogged with construction dirt and debris which may cause system damage.

Step 2 — Check Unit — Upon receipt of shipment at the jobsite, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the carton or crating of each unit, and inspect each unit for damage. Ensure the shipping company makes proper notation of any shortages or damage on all copies of the freight bill. Concealed damage not discovered during unloading must be reported to the shipping company within 15 days of receipt of shipment.

NOTE: It is the responsibility of the purchaser to file all necessary claims with the shipping company.

1. Verify unit is correct model for entering water temperature of job.
2. Be sure that the location chosen for unit installation provides ambient temperatures maintained above freezing. Well water applications are especially susceptible to freezing.
3. Be sure the installation location is isolated from sleeping areas, private offices and other acoustically sensitive spaces.

NOTE: A sound control accessory package may be used to help eliminate sound in sensitive spaces.

4. Check local codes to be sure a secondary drain pan is not required under the unit.
5. Be sure unit is mounted at a height sufficient to provide an adequate slope of the condensate lines. If an appropriate slope cannot be achieved, a field-supplied condensate pump may be required.
6. Provide sufficient space for duct connection.
7. Provide adequate clearance for filter replacement and drain pan cleaning. Do not allow piping, conduit, etc. to block filter access.
8. Provide sufficient access to allow maintenance and servicing of the fan and fan motor, compressor and coils. Removal of the entire unit from the closet should not be necessary.
9. Provide an unobstructed path to the unit within the closet or mechanical room. Space should be sufficient to allow removal of unit if necessary.
10. Provide ready access to water valves and fittings, and screwdriver access to unit side panels, discharge collar, and all electrical connections.
11. Where access to side panels is limited, pre-removal of the control box side mounting screws may be necessary for future servicing.

STORAGE — If the equipment is not needed immediately at the jobsite, it should be left in its shipping carton and stored in a clean, dry area of the building or in a warehouse. Units must be stored in an upright position at all times. If carton stacking is necessary, stack units a maximum of 3 high. Do not remove any equipment from its shipping package until it is needed for installation.

PROTECTION — Once the units are properly positioned on the jobsite, cover them with either a shipping carton, vinyl film, or an equivalent protective covering. Cap open ends of pipes stored on the jobsite. This precaution is especially important in areas where painting, plastering, or spraying of fireproof material, etc. is not yet complete. Foreign material that accumulates within the units can prevent proper start-up and necessitate costly clean-up operations.

Before installing any of the system components, be sure to examine each pipe, fitting, and valve, and remove any dirt or foreign material found in or on these components.

⚠ CAUTION

DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move units in an upright position. Tilting units on their sides may cause equipment damage.

INSPECT UNIT — To prepare the unit for installation, complete the procedures listed below:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Verify that the unit is the correct model for the entering water temperature of the job.

3. Do not remove the packaging until the unit is ready for installation.
4. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
5. Inspect all electrical connections. Be sure connections are clean and tight at the terminals.
6. Compressors are internally isolated. Compressors equipped with external spring vibration isolators must have bolts loosened and shipping clamps removed.
7. Remove any blower support cardboard from inlet of the blower.
8. Locate and verify any accessory kit located in compressor section.
9. Remove any access panel screws that may be difficult to remove once unit is installed.

Table 1 — Physical Data — Aquazone™ 50RHE006-060 Units

UNIT 50RHE	006	009	012	015	019	024	030	036	042	048	060
COMPRESSOR (1 each)	Rotary					Reciprocating					Scroll
FACTORY CHARGE R-407C (kg)	0.34	0.37	0.37	0.68	0.88	0.91	1.19	1.36	1.19	1.59	2.41
PSC FAN MOTOR AND BLOWER											
Fan Motor Type/Speeds	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3
Fan Motor (Hp) [w]	1/25 [30]	1/10 [75]	1/10 [75]	1/6 [124]	1/5 [150]	1/3 [250]	1/2 [373]	3/4 [560]	3/4 [560]	3/4 [560]	1 [746]
Blower Wheel Size (D x W) (mm)	127 x 127	127 x 127	152 x 127	152 x 127	152 x 127	152 x 127	152 x 127	254 x 254	254 x 254	254 x 254	279 x 254
WATER CONNECTION SIZE (in.) (FPT)	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1	1
HORIZONTAL											
Air Coil											
Dimensions (H x W) (mm)	254 x 406			406 x 406			457 x 559		457 x 787		508 x 889
Total Face Area (m ²)	0.103			0.165			0.255		0.360		0.452
Tube Size (mm)	9.5			9.5			9.5		9.5		9.5
Distance Between Fins (mm)	2.2			2.2			2.2		2.2		2.7
Number of Rows	2			3			3		3		4
Filter Standard Throwaway	1 — 254 x 508			1 — 406 x 508			1 — 457 x 610		2 — 457 x 457		1 — 305 x 508
(Qty — Size, mm)											1 — 635 x 508
Weight 25.4-mm (kg)											
Operating	50.0	50.9	55.0	66.8	76.8	87.7	99.5	104.1	116.8	121.4	146.8
Packaged	54.5	55.5	59.5	71.4	81.4	92.3	105.0	109.5	122.3	126.8	153.6

LEGEND

PSC — Permanent Split Capacitor

NOTES:

1. All units have spring compressor mountings, TXV (thermostatic expansion valve) expansion devices, and 1/2- and 3/4-in. electrical knockouts.
2. Size 048 available as high-static unit.

50RHE UNITS		OVERALL CABINET			WATER CONNECTIONS				ELECTRICAL KNOCKOUTS (in.)			DISCHARGE CONNECTION Duct Flange Installed (±0.10 in.)						RETURN CONNECTION Using Return Air Opening			
					1	2	3	Loop Water FPT (in.)	1/2 conduit	K 1/2 conduit	L 3/4 conduit										
		A Width	B Depth	C Height	D In	E Out	F Cond- ensate		Low Voltage	Ext Pump	Power Supply	J	K	L Supply Height	M Supply Depth	N	O	P Return Depth	Q Return Height	R	S
006-012	in. cm	22.4 56.8	43.1 109.5	11.3 28.7	2.4 6.1	5.4 13.7	0.6 1.5	1/2	3.5 8.9	5.5 14.0	8.2 20.8	5.8 14.7	4.0 10.2	5.8 14.7	8.0 20.3	5.8 14.7	1.5 3.8	17.1 43.4	9.3 23.6	2.2 5.6	1.0 2.5
015-024	in. cm	22.4 56.8	43.1 109.5	17.3 43.9	2.4 6.1	4.9 12.4	0.6 1.5	3/4	3.5 8.9	7.5 19.1	10.2 25.9	5.0 12.7	5.6 14.2	10.4 26.4	9.3 23.6	5.0 12.7	1.5 3.8	17.1 43.4	15.3 38.9	2.2 5.6	1.0 2.5
030	in. cm	22.4 56.8	53.2 135.1	19.3 49.0	2.4 6.1	5.4 13.7	0.6 1.5	3/4	5.7 14.5	9.7 24.6	12.2 31.0	5.0 12.7	6.8 17.3	10.4 26.4	9.3 23.6	5.0 12.7	2.1 5.3	23.1 58.7	17.3 43.9	2.2 5.6	1.0 2.5
036	in. cm	22.4 56.8	53.2 135.1	19.3 49.0	2.4 6.1	5.4 13.7	0.6 1.5	3/4	5.7 14.5	9.7 24.6	12.2 31.0	2.9 7.4	3.8 9.7	13.5 34.3	13.1 33.3	2.9 7.4	1.9 4.8	23.1 58.7	17.3 43.9	2.2 5.6	1.0 2.5
042-048	in. cm	22.4 56.8	62.2 158.0	19.3 49.0	2.4 6.1	5.4 13.7	0.6 1.5	1	5.7 14.5	9.7 24.6	12.2 31.0	2.9 7.4	3.8 9.7	13.5 34.3	13.1 33.3	2.9 7.4	1.9 4.8	32.1 81.5	17.3 43.9	2.2 5.6	1.0 2.5
060	in. cm	25.4 64.5	71.2 180.8	21.3 54.1	2.4 6.1	5.4 13.7	0.6 1.5	1	8.1 20.6	11.7 29.7	14.2 36.1	5.8 14.7	5.0 12.7	13.6 34.5	13.3 33.8	5.8 14.7	2.9 7.4	36.1 91.7	19.3 49.0	2.2 5.6	1.0 2.5

- NOTES:
1. Condensate is 3/4-in. FPT copper.
 2. Horizontal unit shipped with filter bracket only. This bracket should be removed for return duct connection (front).
 3. Hanger kit is factory installed. Isolation grommets are provided.
 4. Right and left orientation is determined by looking at water connection side.

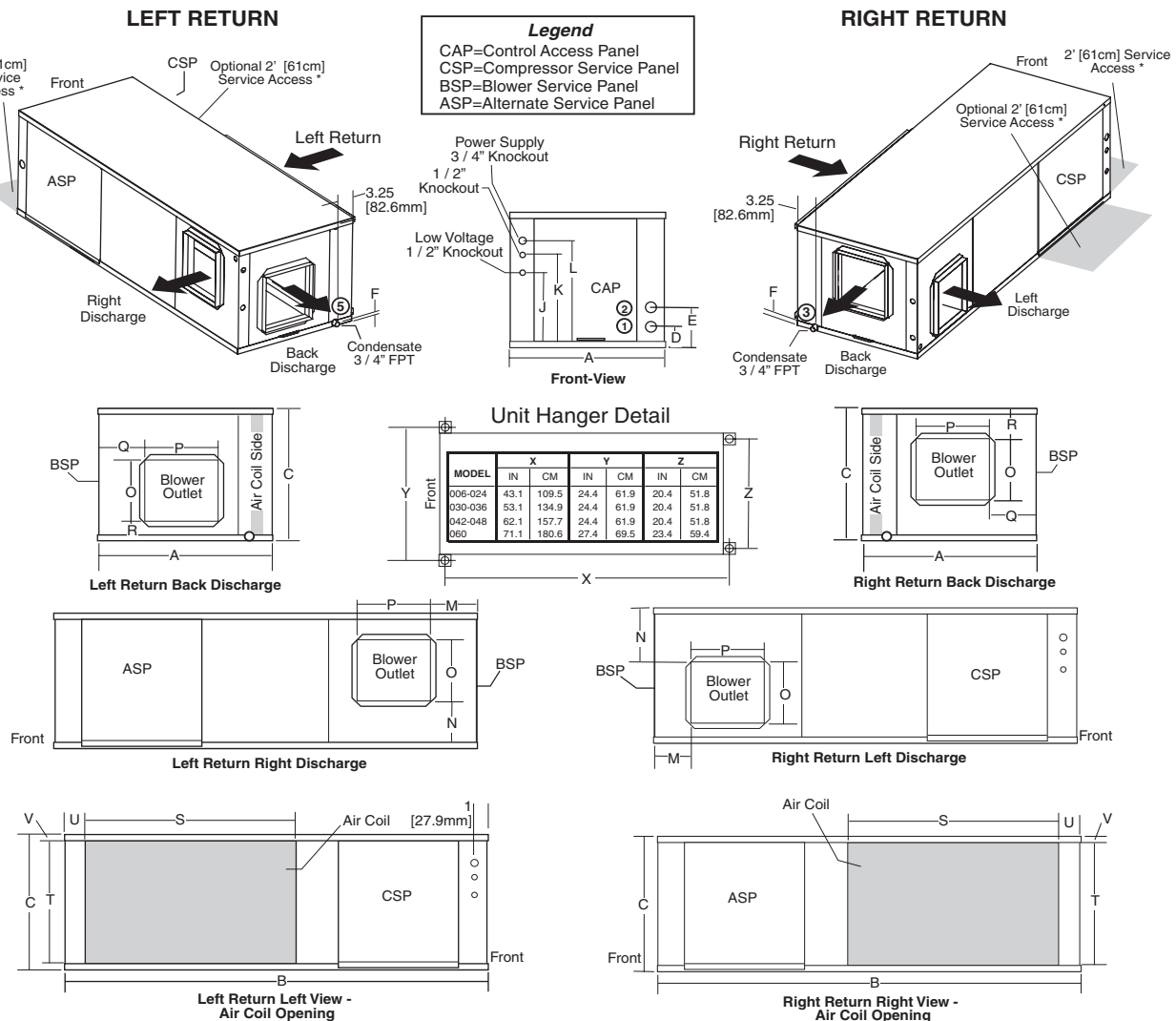
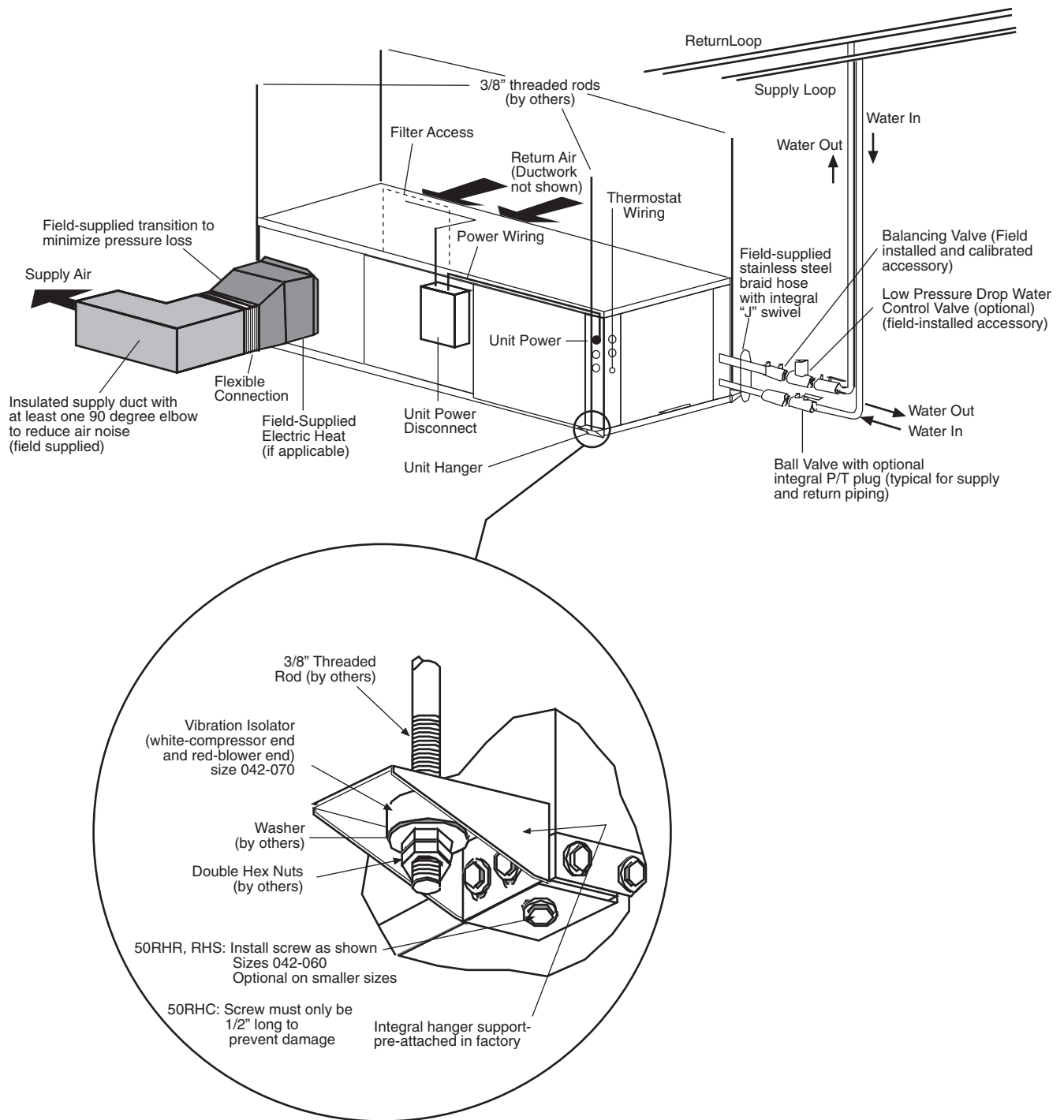


Fig. 1 — 50RHE Dimensional Data



UNIT HANGER ISOLATION DETAIL

Fig. 2 — Typical Installation — 50RHE Units

Step 3 — Unit Location — The following guidelines should be considered when choosing a location for a WSHP unit:

- Units are for indoor use only
- Locate in areas where ambient temperatures are between 4.4 C and 37.8 C and relative humidity is no greater than 75%
- Provide sufficient space for water, electrical and duct connections
- Locate unit in an area that allows easy access and removal of filter and access panels
- Allow enough space for service personnel to perform maintenance
- Return air must be able to freely enter the space if unit needs to be installed in a confined area such as a closet

NOTE: Correct placement of the horizontal unit can play an important part in minimizing sound problems. Since ductwork is normally applied to these units, the unit can be placed so that the principal sound emission is outside the occupied space in sound-critical applications. A fire damper may be required by the local code if a fire wall is penetrated.

FIELD CONVERSION OF DISCHARGE AIR — The discharge air of the 50RHE horizontal units can be converted between side and back discharge in the field. The conversion process is the same for right and left return configurations. See Fig. 3 and 4.

NOTE: It is not possible to convert return air between left or right return models in the field due to refrigerant piping changes.

Preparation — The unit should be on the ground in a well lit area for conversion. Hung units should be taken down to ground level before converting.

Side to Back Discharge Conversion

1. Remove screws to free the top and discharge panels. See Fig. 3.
2. Remove the access panel and set aside.
3. Lift the discharge panel from side of unit and rotate it to back using care not to damage blower wiring.
4. Check blower wire routing and connections for excessive tension or contact with sheet metal edges. Re-route if necessary.
5. Check refrigerant tubing for contact with other components. Adjust if necessary.
6. Reinstall top panel using screws set aside in Step 1.

NOTE: Location for some screws at bottom of discharge panel may have to be changed.

7. Manually spin fan wheel to check for obstructions. Adjust for any obstruction found.
8. Replace access panel.

Back to Side Discharge Conversion — Follow instructions above for Side to Back Discharge Conversion, noting the panels would be reversed.

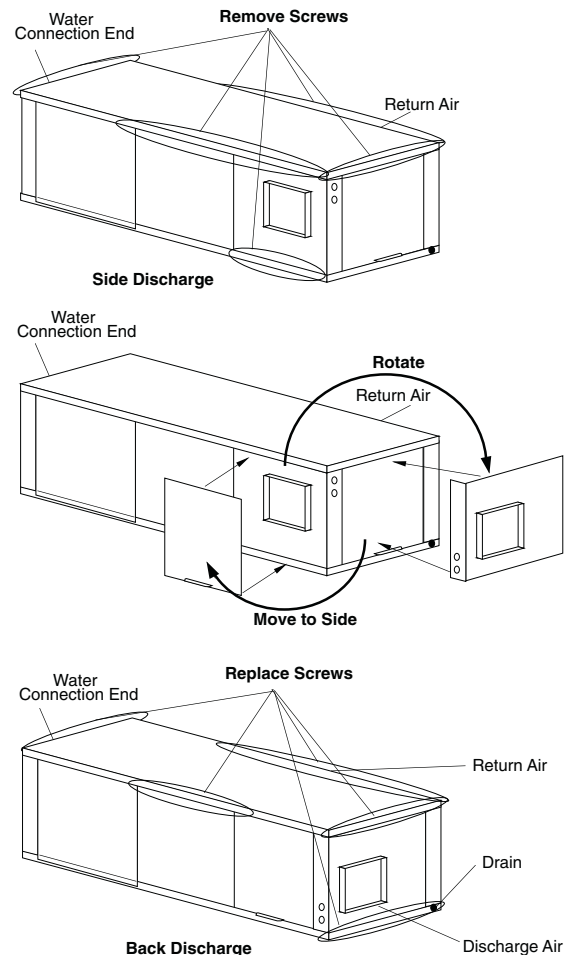


Fig. 3 — Conversion Left Return, Side Discharge to Back Discharge

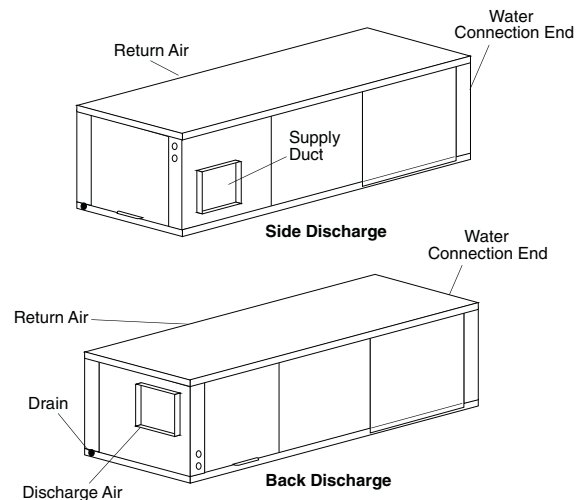


Fig. 4 — Conversion Right Return, Side Discharge to Back Discharge

Step 4 — Mounting the Unit — Horizontal units should be mounted using the factory-installed hangers. Proper attachment of hanging rods to building structure is critical for safety. See Fig. 2 and 5. Rod attachments must be able to support the weight of the unit. See Table 1 for unit operating weights.

Step 5 — Duct System — Size the duct system to handle the design airflow quietly.

NOTE: Depending on the unit, the fan wheel may have a shipping support installed at the factory. This must be removed before operating unit.

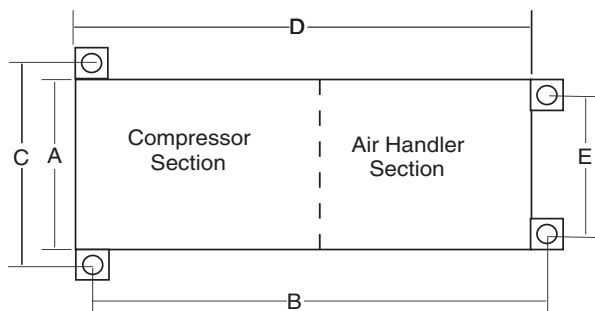
SOUND ATTENUATION — To eliminate the transfer of vibration to the duct system, a flexible connector is recommended for both discharge and return air duct connections on metal duct systems. The supply and return plenums should include internal duct liner of fiberglass or be made of duct board construction to maximize sound attenuation of the blower. Installing the WSHP unit to uninsulated ductwork in an unconditioned space is not recommended since it will sweat and adversely affect the unit's performance.

To reduce air noise, at least one 90 degree elbow could be included in the supply and return air ducts, provided system performance is not adversely impacted. The blower speed can also be changed in the field to reduce air noise or excessive airflow, provided system performance is not adversely impacted.

EXISTING DUCT SYSTEM — If the unit is connected to existing ductwork, consider the following:

- Verify that the existing ducts have the proper capacity to handle the unit airflow. If the ductwork is too small, install larger ductwork.
- Check existing ductwork for leaks and repair as necessary.

NOTE: Local codes may require ventilation air to enter the space for proper indoor air quality. Hard-duct ventilation may be required for the ventilating air supply. If hard ducted ventilation is not required, be sure that a proper air path is provided for ventilation air to unit to meet ventilation requirement of the space.



50RHE UNITS	DIMENSIONS (mm)				
	A	B	C	D	E
006-024	568	1095	619	1095	518
030,036	568	1349	619	1349	518
042,048	568	1577	619	1577	518
060	645	1806	695	1806	594

Fig. 5 — Horizontal Hanger Bracket (Factory Installed)

Step 6 — Condensate Drain — Slope the unit toward the drain at a 6.5 mm per 30 cm pitch. See Fig. 6. If it is not possible to meet the required pitch, install a condensate pump at the unit to pump condensate to building drain.

Horizontal units are not internally trapped; therefore an external trap is necessary. Install each unit with its own individual trap and means to flush or blowout the condensate drain line. Do not install units with a common trap or vent. For typical condensate connections see Fig. 7.

NOTE: Never use a pipe size smaller than the connection.

VENTING — Install a vent in the condensate line of any application that may allow dirt or air to collect in the line. Consider the following:

- Always install a vent where an application requires a long horizontal run.
- Always install a vent where large units are working against higher external static pressure and to allow proper drainage for multiple units connected to the same condensate main.
- Be sure to support the line where anticipated sagging from the condensate or when "double trapping" may occur.
- If condensate pump is present on unit, be sure drain connections have a check valve to prevent back flow of condensate into other units.

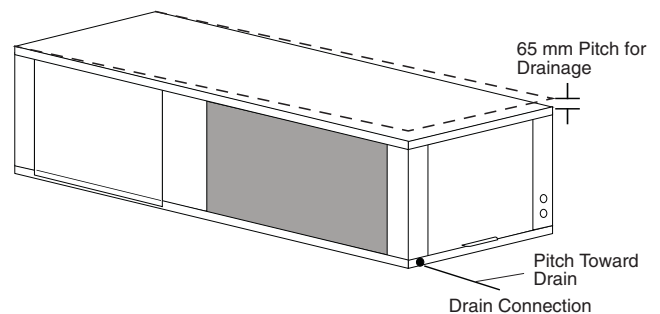
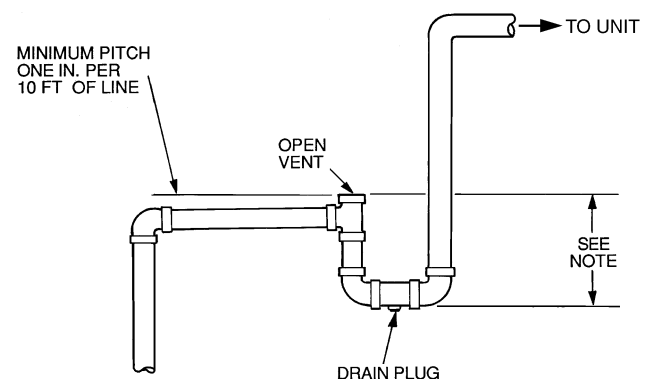


Fig. 6 — Horizontal Unit Pitch



NOTE: Trap should be deep enough to offset maximum unit static difference. A 102 mm trap is recommended.

Fig. 7 — Trap Condensate Drain

Step 7 — Piping Connections — Depending on the application, there are 3 types of WSHP piping systems to choose from: water loop, ground-water and ground loop. Refer to Piping Section of Carrier System Design Manual for additional information.

All WSHP units use low temperature soldered female pipe thread fittings for water connections to prevent annealing and out-of-round leak problems which are typically associated with high temperature brazed connections. Refer to Table 1 for connection sizes. When making piping connections, consider the following:

- Use a backup wrench when making screw connections to unit to prevent internal damage to piping.
- Insulation may be required on piping to avoid condensation in the case where fluid in loop piping operates at temperatures below dew point of adjacent air.
- Piping systems that contain steel pipes or fittings may be subject to galvanic corrosion. Dielectric fittings should be used to isolate the steel parts of the system to avoid galvanic corrosion.

WATER LOOP APPLICATIONS — Water loop applications usually include a number of units plumbed to a common piping system. Maintenance to any of these units can introduce air into the piping system. Therefore, air elimination equipment comprises a major portion of the mechanical room plumbing.

The flow rate is usually set between 0.040 and 0.054 l/s per kW of cooling capacity. For proper maintenance and servicing, pressure-temperature (P/T) ports are necessary for temperature and flow verification.

In addition to complying with any applicable codes, consider the following for system piping:

- Piping systems using water temperatures below 10 C require 12.7 mm closed cell insulation on all piping surfaces to eliminate condensation.
- Avoid all plastic to metal threaded fittings due to the potential to leak. Use a flange fitted substitute.
- Teflon tape thread sealant is recommended to minimize internal fouling of the heat exchanger.
- Use backup wrench. Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Flush the piping system prior to operation to remove dirt and foreign materials from the system.

GROUND-WATER APPLICATIONS — Typical ground-water piping is shown in Fig. 8. In addition to complying with any applicable codes, consider the following for system piping:

- Install shut-off valves for servicing.
- Install pressure-temperature plugs to measure flow and temperature.
- Connect boiler drains and other valves using a “T” connector to allow acid flushing for the heat exchanger.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Use PVC SCH80 or copper piping material.

NOTE: PVC SCH40 should *not* be used due to system high pressure and temperature extremes.

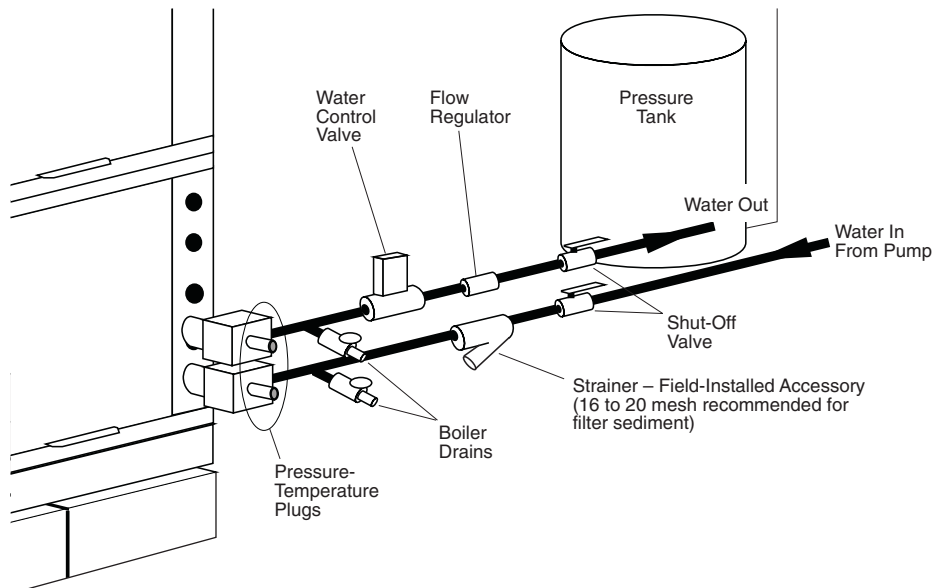


Fig. 8 — Typical Ground-Water Piping Installation

Water Supply and Quantity — Check water supply. Water supply should be plentiful and of good quality. See Table 2 for water quality guidelines.

IMPORTANT: Failure to comply with the above required water quality and quantity limitations and the closed-system application design requirements may cause damage to the tube-in-tube heat exchanger that is not the responsibility of the manufacturer.

In all applications, the quality of the water circulated through the heat exchanger must fall within the ranges listed in the Water Quality Guidelines table. Consult a local water treatment firm, independent testing facility, or local water authority for specific recommendations to maintain water quality within the published limits.

GROUND-LOOP APPLICATIONS — Temperatures between -4 to 43 C and a liquid flow rate of 0.040 to 0.054 l/s per kW of cooling capacity is recommended. In addition to complying with any applicable codes, consider the following for system piping:

- Limit piping materials to only polyethylene fusion in the buried sections of the loop.
- Do not use galvanized or steel fittings at any time due to corrosion.
- Avoid all plastic to metal threaded fittings due to the potential to leak. Use a flange fitted substitute.
- Do not overtighten connections.
- Route piping to avoid service access areas to unit.
- Use pressure-temperature (P/T) plugs to measure flow of pressure drop.

Step 8 — Electrical Wiring

⚠ WARNING

To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

⚠ CAUTION

Use only copper conductors for field-installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

All field installed wiring, including the electrical ground, MUST comply with applicable local, national and regional codes.

Refer to unit wiring diagrams Fig. 9-12 for a schematic of the field connections, which must be made by the installing (or electrical) contractor. Refer to Electrical Data for fuse sizes.

Consult the unit wiring diagram located on the inside of the compressor access panel to ensure proper electrical hookup. The installing (or electrical) contractor must make the field connections when using field-supplied disconnect.

Operating voltage must be the same voltage and phase as shown in Electrical Data shown in Table 3.

Make all final electrical connections with a length of flexible conduit to minimize vibration and sound transmission to the building.

Table 2 — Water Quality Guidelines

CONDITION	ACCEPTABLE LEVEL		
pH	7 to 9 range for copper. Cupronickel may be used in the 5 to 9 range.		
Total Hardness	Calcium and magnesium carbonate should not exceed 350 ppm.		
Iron Oxides	Less than 1 ppm.		
Iron Bacteria	No level allowable.		
Corrosion*	Ammonia, Ammonium Hydroxide Ammonium Chloride, Ammonium Nitrate Ammonium Sulfate Chlorine/Chlorides Hydrogen Sulfide†	Max Allowable Level 0.5 ppm 0.5 ppm 0.5 ppm 0.5 ppm None Allowable	Coaxial Metal Cu Cu Cu CuNi —
Brackish	Use Cupronickel heat exchanger when concentrations of calcium or sodium chloride are greater than 125 ppm are present. (Seawater is approximately 25,000 ppm.)		

*If the concentration of these corrosives exceeds the maximum allowable level, then the potential for serious corrosion problems exists.

†Sulfides in the water quickly oxidize when exposed to air, requiring that no agitation occur as the sample is taken. Unless tested immediately at the site, the sample will require stabilization with a few drops of one Molar zinc acetate solution, allowing accurate sulfide determination up to 24 hours after sampling. A low pH and high alkalinity cause system problems, even when both values are within ranges shown. The term pH refers to the acidity, basicity, or neutrality of the water supply. Below 7.0, the water is considered to be acidic. Above 7.0, water is considered to be basic. Neutral water contains a pH of 7.0.

NOTE: Hardness in mg/l is equivalent to ppm.

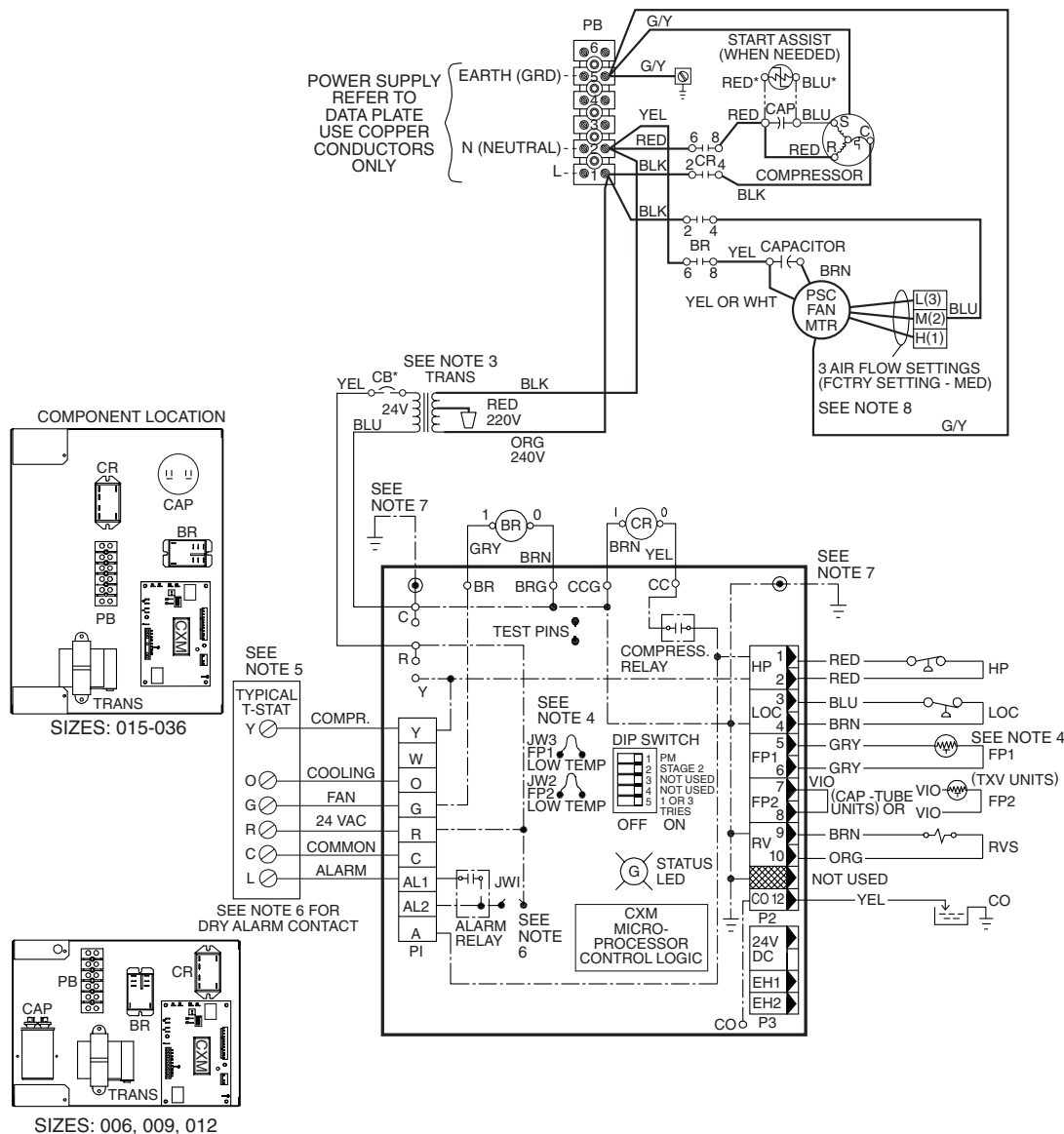
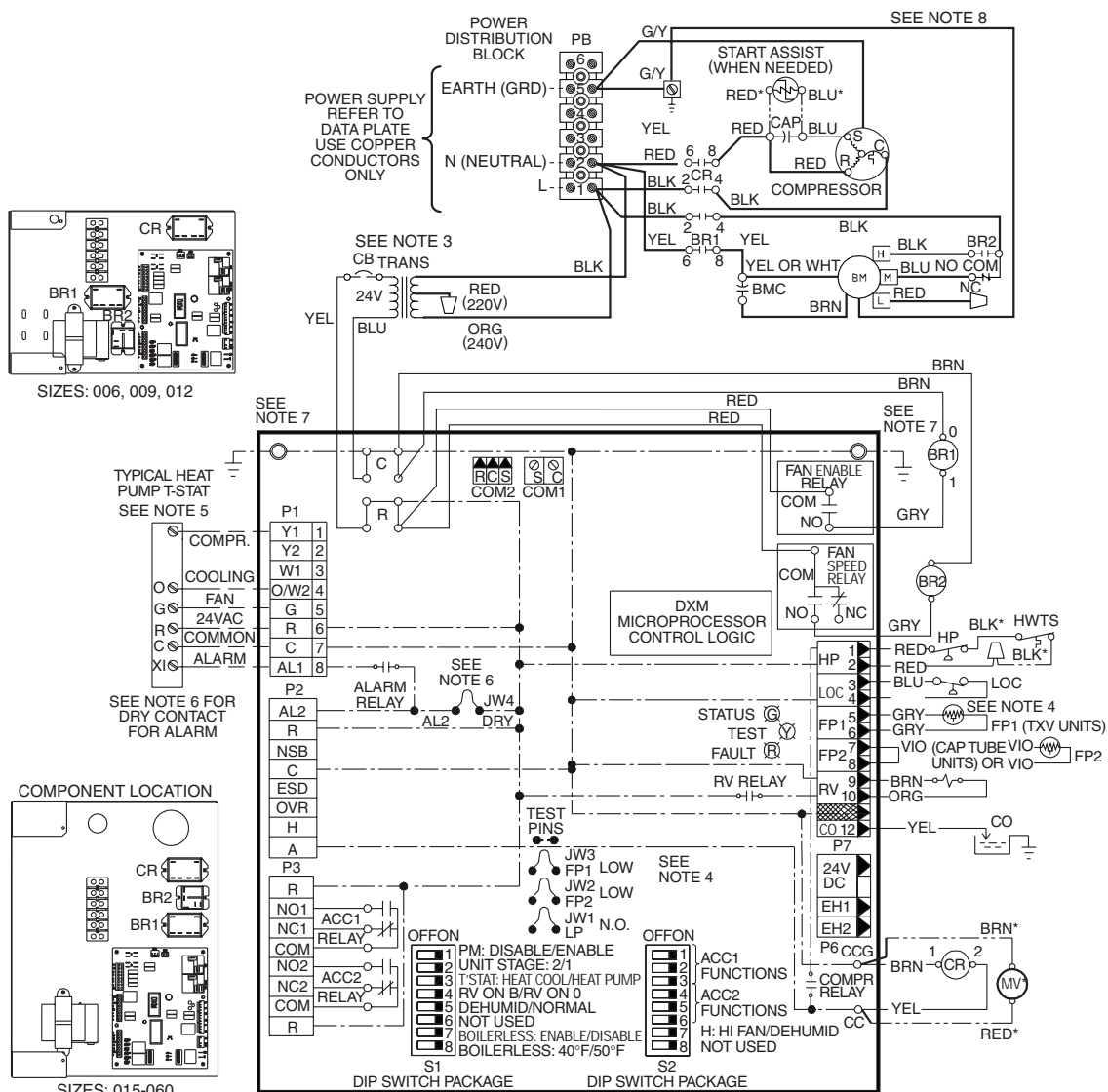


Fig. 9 — Typical Aquazone™ Complete C Control Wiring (Single-Phase Unit)



LEGEND

AL — Alarm Relay Contacts
BM — Blower Motor
BMC — Blower Motor Capacitor
BR — Blower Relay
CAP — Compressor Capacitor
CB — Circuit Breaker
CO — Sensor, Condensate Overflow
FP1 — Sensor, Water Coil Freeze Protection
FP2 — Sensor, Air Coil Freeze Protection
GND — Ground
HP — High-Pressure Switch
HWTS — High (Leaving) Water Temp Switch
JW — Clippable Field Selection Jumper
LOC — Loss of Charge Pressure Switch
MV — Motorized Valve

P1 — Field Wiring Terminal Block
PB — Power Block
PM — Performance Monitor
PSC — Permanent Split Capacitor
RVS — Reversing Valve Solenoid
TRANS — Transformer Optional Wiring

— — — — — Field Line Voltage Wiring
 - - - - - Field Low Voltage Wiring
 - · - · - Printed Circuit Trace
 - · · - Optional Wiring

○ ○ ○ Relay/Contactor Coil

⊗ Thermistor
 ⊞ Condensate Pan
 ⊙ LED
 ⊕ Solenoid Coil
 ⊖ Relay Contacts — N.O.
 ⊗ Temperature Switch
 ⊕ Switch — Loss of Charge
 ⊖ Ground
 ⊗ Wire Nut

*Optional wiring.

NOTES:

- Compressor thermally protected internally.
- All wiring to the unit must comply with NEC and local codes.
- Transformer is wired to 240 v (ORG) lead for 240/50/1 units, switch RED and ORG leads to PB(1) and insulate ORG lead for 220/50/1.
- FP1 thermistor provides freeze protection for water. When using antifreeze solutions, cut JW3 jumper.
- Check installation wiring information for specific thermostat hookup. Refer to thermostat installation instructions for wiring to the unit. Thermostat wiring must be "Class 1" and voltage rating equal to or greater than unit supply voltage.

- 24-v alarm signal shown. For dry alarm contact, cut JW4 jumper, and dry contact will be available between AL1 and AL2.
- Transformer secondary ground via microprocessor board stand-offs and screws to control box. (Ground available from top two standoffs as shown.)
- Blower motor is factory wired for medium and high speeds. For any other combination of speeds, at the motor attach black wire to the higher of the two desired speed taps, and the blue wire to the lower of the two desired speed taps.

Fig. 11 — Typical Aquazone™ Deluxe D Control Wiring (Single-Phase Unit)

Table 3 — Electrical Data

50RHE UNIT	VOLTS-PHASE (50 Hz)	VOLTAGE MIN/MAX	COMPRESSOR		FAN MOTOR FLA	TOTAL UNIT FLA	MIN CIRCUIT AMP	MAX FUSE/HACR
			RLA	LRA				
006	220/240-1	197/254	2.3	15.0	0.4	2.7	3.2	15
009	220/240-1	197/254	2.7	18.8	0.7	3.7	4.5	15
012	220/240-1	197/254	3.9	22.2	0.7	4.5	5.6	15
015	220/240-1	197/254	4.2	27.0	0.9	5.9	7.1	15
019	220/240-1	197/254	6.8	45.0	0.9	8.6	10.5	15
024	220/240-1	197/254	8.2	51.0	1.6	10.4	12.6	20
030	220/240-1	197/254	9.1	54.0	1.7	11.2	13.6	20
	380-415-3	342/462	3.3	25.0	1.0	4.3	5.2	15
036	220/240-1	197/254	11.5	83.0	2.7	17.2	20.8	35
	380-415-3	342/462	4.2	32.0	1.7	5.9	6.9	15
042	380-415-3	342/462	5.5	34.5	1.7	6.0	7.1	15
048	380-415-3	342/462	5.9	42.0	1.8	7.5	8.9	15
060	380-415-3	342/462	8.2	61.8	2.5	9.9	11.8	15

LEGEND

FLA — Full Load Amps
HACR — Heating, Air Conditioning and Refrigeration
LRA — Locked Rotor Amps
RLA — Rated Load Amps

POWER CONNECTION — Make line voltage connection by connecting the incoming line voltage wires to the L side of the CC terminal as shown in Fig. 13. See Table 3 for correct wire and maximum overcurrent protection sizing.

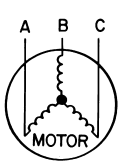
SUPPLY VOLTAGE — Operating voltage to unit must be within voltage range indicated on unit nameplate.

On 3-phase units, voltages under load between phases must be balanced within 2%. Use the following formula to determine the percentage voltage imbalance:

% Voltage Imbalance

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 460-3-60.



AB = 452 volts
 BC = 464 volts
 AC = 455 volts

$$\begin{aligned} \text{Average Voltage} &= \frac{452 + 464 + 455}{3} \\ &= \frac{1371}{3} \\ &= 457 \end{aligned}$$

Determine maximum deviation from average voltage:

(AB) 457 – 452 = 5 v
 (BC) 464 – 457 = 7 v
 (AC) 457 – 455 = 2 v

Maximum deviation is 7 v.

Determine percent voltage imbalance.

$$\begin{aligned} \% \text{ Voltage Imbalance} &= 100 \times \frac{7}{457} \\ &= 1.53\% \end{aligned}$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

Operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.

NOTE: If more than 2% voltage imbalance is present, contact local electric utility.

220-VOLT OPERATION — All 220-240 volt units are factory wired for 208 volts. The transformers may be switched to 220-volt operation by switching the red (220 volt) wire with the orange (240 volt) wire at the TB1-1 terminal for single-phase and TB1-3 for 3-phase.

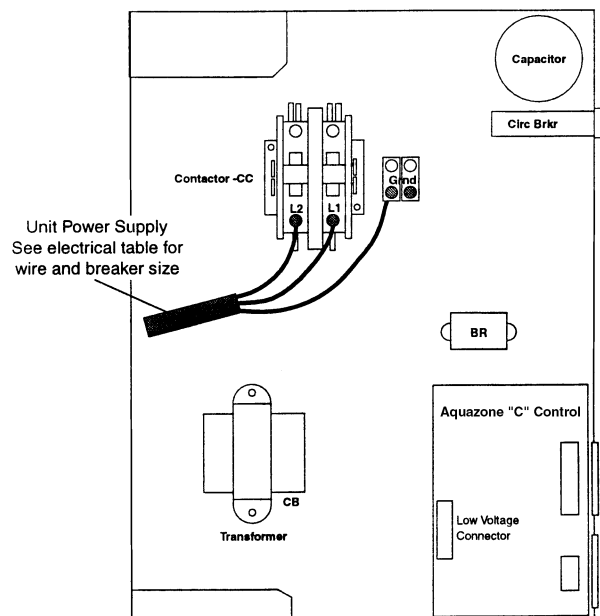


Fig. 13 — 50RHE Typical Single-Phase Line Voltage Power Connection

PSC (PERMANENT SPLIT CAPACITOR) BLOWER SPEED SELECTION — All Water Source Heat Pumps are factory set to deliver rated airflow at nominal static (37 Pa) on medium speed. Where higher static is needed, high speed can be utilized (100 to 125 Pa). Low speed will deliver approximately 85% of rated airflow (25 Pa). The PSC blower fan speed can be changed on all units by swapping wires connected to the relay contacts that control the fan. See Table 4 and Fig. 14.

NOTE: Available airflow for all units is shown in Table 4.

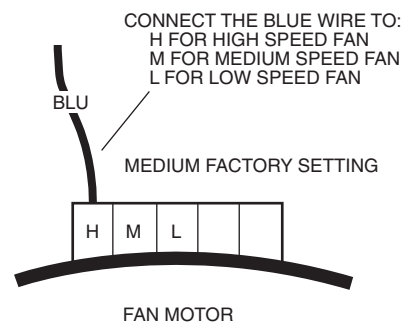


Fig. 14 — 50RHE Blower Speed Selection

Table 4 — 50RHE Blower Performance

50RHE UNIT	NOMINAL AIRFLOW (L/s)	MINIMUM AIRFLOW (L/s)	FAN SPEED	AIRFLOW (L/s)					
				External Static Pressure (Pa)					
				0	25	50	75	100	125
006	81	61	HI	133	123	112	89	78	—
			MED	110	99	87	68	—	—
			LO	98	90	75	60	—	—
009	113	85	HI	165	151	142	118	99	—
			MED	160	146	127	113	94	—
			LO	151	137	123	109	90	—
012	140	104	HI	170	165	151	137	123	109
			MED	165	151	142	127	118	—
			LO	146	137	127	118	104	—
015	212	160	HI	345	316	288	250	198	—
			MED	321	302	274	241	189	—
			LO	293	278	255	222	179	—
019	264	198	HI	326	311	283	250	203	—
			MED	302	288	260	227	189	—
			LO	293	269	245	217	179	—
024	307	231	HI	396	368	335	302	260	—
			MED	387	359	326	297	255	—
			LO	368	340	311	278	231	—
030	349	264	HI	529	496	463	425	378	330
			MED	510	477	448	415	368	326
			LO	458	439	406	378	340	297
036	437	326	HI	614	576	519	463	415	373
			MED	580	543	488	434	392	349
			LO	505	472	429	387	349	—
042	530	396	HI	743	691	629	566	501	435
			MED	637	593	539	485	429	—
			LO	498	463	421	—	—	—
048	630	472	HI	793	738	672	604	535	464
			MED	777	723	658	592	524	455
			LO	762	709	645	580	514	446
High Static 048	630	472	HI	—	—	—	757	668	552
			MED	—	—	787	710	623	529
			LO	—	797	748	690	612	516
060	790	595	HI	896	866	833	796	755	710
			MED	818	803	779	747	707	658
			LO	748	731	709	683	653	618

LEGEND

Shaded areas are below minimum CFM. This data is provided for troubleshooting information only.

NOTES:

1. Units factory shipped on medium speed. Other speeds require field selection.
2. For dual voltage units, airflow is rated at lowest voltage.
3. Performance data shown is based on wet coil and clean air filter.

Step 9 — Low Voltage Wiring (See Fig. 15)

THERMOSTAT CONNECTIONS — The thermostat should be wired directly to the Aquazone™ control board. See Fig. 9-12.

WATER FREEZE PROTECTION — The Aquazone control allows the field selection of source fluid freeze protection points through jumpers. The factory setting of jumper JW3 (FP1) is set for water at -1.1°C . In earth loop applications, jumper JW3 should be clipped to change the setting to -10.6°C when using antifreeze in colder earth loop applications. See Fig. 16.

AIR COIL FREEZE PROTECTION — The air coil freeze protection jumper JW2 (FP2) is factory set for -1.1°C and should not need adjusting.

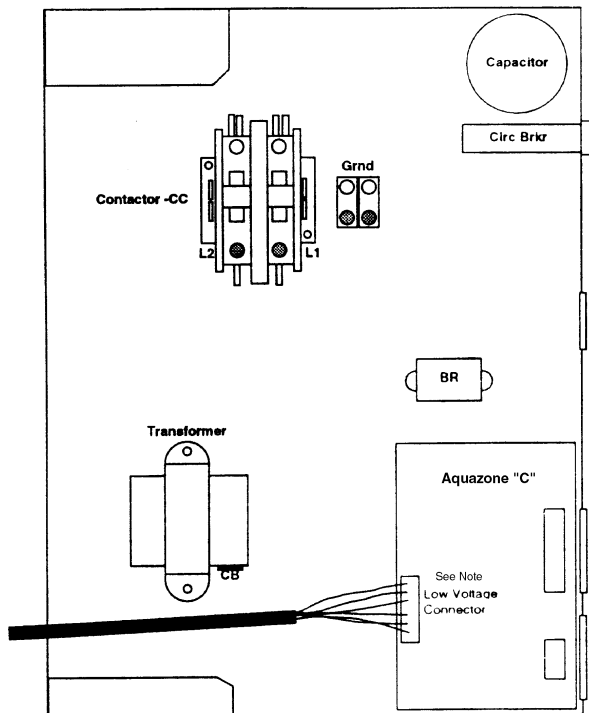
ACCESSORY CONNECTIONS — Terminal A on the control is provided to control accessory devices such as water valves, electronic air cleaners, humidifiers, etc. This signal operates with the compressor terminal. See Fig. 17. Refer to the specific unit wiring schematic for details.

NOTE: The A terminal should *only* be used with 24-volt signals — not line voltage signals.

WATER SOLENOID VALVES — Water solenoid valves may be used on primary/secondary pump and ground water installations. A typical well water control valve wiring approach, which can limit waste water in a lockout condition, is shown in Fig. 17. A slow closing valve may be required to prevent water hammer. When using a slow closing valve, consider special wiring conditions. The valve takes approximately 60 seconds to open (very little water will flow before 45 seconds) and it activates the compressor only after the valve is completely opened by closing its end switch. When wired as shown, the valve will have the following operating characteristics:

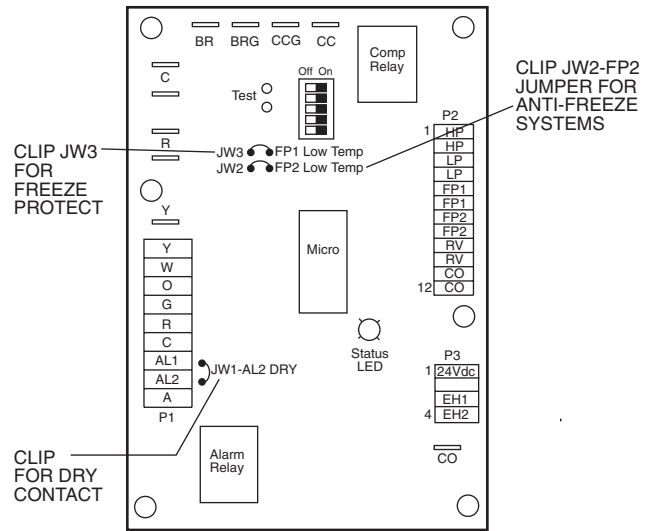
1. Remain open during a lockout
2. Draw approximately 25 to 35 VA through the “Y” signal of the thermostat.

IMPORTANT: Connecting a water solenoid valve can overheat the anticipators of electromechanical thermostats. Only use relay based electronic thermostats.



NOTE: Low voltage connector may be removed for easy installation.

Fig. 15 — Low Voltage Field Wiring



AQUAZONE CONTROL (C Control Shown)

Fig. 16 — Typical Aquazone Control Board Jumper Locations

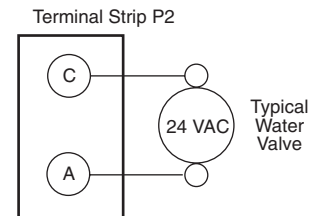


Fig. 17 — Typical D Control Accessory Wiring

PRE-START-UP

System Checkout — When the installation is complete, follow the System Checkout procedure outlined below before starting up the system. Be sure:

1. Voltage is within the utilization range specifications of the unit compressor and fan motor and voltage is balanced for 3-phase units.
2. Fuses, breakers and wire are correct size.
3. Low voltage wiring is complete.
4. Piping and system flushing is complete.
5. Air is purged from closed loop system.
6. System is balanced as required. Monitor if necessary.
7. Isolation valves are open.
8. Water control valves or loop pumps are wired.
9. Condensate line is open and correctly pitched.
10. Transformer switched to lower voltage tap if necessary.
11. Blower rotates freely — shipping support is removed.
12. Blower speed is on correct setting.
13. Air filter is clean and in position.
14. Service/access panels are in place.
15. Return air temperature is between 4.4 to 26.7°C heating and 10 to 43.3°C cooling.
16. Air coil is clean.
17. Control field selected settings are correct.

AIR COIL — To obtain maximum performance, clean the air coil before starting the unit. A ten percent solution of dishwashing detergent and water is recommended for both sides of the coil. Rinse thoroughly with water.

FIELD SELECTABLE INPUTS

Jumpers and DIP (dual in-line package) switches on the control board are used to customize unit operation and can be configured in the field.

IMPORTANT: Jumpers and DIP switches should only be clipped when power to control board has been turned off.

C Control Jumper Settings (See Fig. 9 and 10)

WATER COIL FREEZE PROTECTION (FP1) LIMIT SETTING — Select jumper 3, (JW3-FP1 Low Temp) to choose FP1 limit of -12.2°C or -1.1°C . To select -1.1°C as the limit, DO NOT clip the jumper. To select -12.2°C as the limit, clip the jumper.

AIR COIL FREEZE PROTECTION (FP2) LIMIT SETTING — Select jumper 2 (JW2-FP2 Low Temp) to choose FP2 limit of -12.2°C or -1.1°C . To select -1.1°C as the limit, DO NOT clip the jumper. To select -12.2°C as the limit, clip the jumper.

ALARM RELAY SETTING — Select jumper 1 (JW1-AL2 Dry) for connecting alarm relay terminal (AL2) to 24 vac (R) or to remain as a dry contact (no connection). To connect AL2 to R, do not clip the jumper. To set as dry contact, clip the jumper.

C Control DIP Switches — The C Control has 1 DIP switch block with five switches. See Fig. 9 and 10.

PERFORMANCE MONITOR (PM) — DIP switch 1 will enable or disable this feature. To enable the PM, set the switch to ON. To disable the PM, set the switch to OFF.

STAGE 2 — DIP switch 2 will enable or disable compressor delay. Set DIP switch to OFF for stage 2 in which the compressor will have a 3-second delay before energizing.

SWITCHES 3 AND 4 — Not used.

1 OR 3 TRIES — DIP switch 5 provides selection of whether there are 1 or 3 tries for FP1 and FP2. This only applies to FP1 and FP2, and not to any other faults. Set DIP switch 5 to ON for 1 try or to OFF for 3 tries.

NOTE: The alarm relay will not cycle during Test mode if switch is set to OFF, stage 2.

D Control Jumper Settings (See Fig. 11 and 12)

WATER COIL FREEZE PROTECTION (FP1) LIMIT SETTING — Select jumper 3, (JW3-FP1 Low Temp) to choose FP1 limit of -12.2°C or -1.1°C . To select -1.1°C as the limit, DO NOT clip the jumper. To select -12.2°C as the limit, clip the jumper.

AIR COIL FREEZE PROTECTION (FP2) LIMIT SETTING — Select jumper 2 (JW2-FP2 Low Temp) to choose FP2 limit of -12.2°C or -1.1°C . To select -1.1°C as the limit, DO NOT clip the jumper. To select -12.2°C as the limit, clip the jumper.

ALARM RELAY SETTING — Select jumper 4 (JW4-AL2 Dry) for connecting alarm relay terminal (AL2) to 24 vac (R) or to remain as a dry contact (no connection). To connect AL2 to R, do not clip the jumper. To set as dry contact, clip the jumper.

LOW PRESSURE SETTING — The D Control can be configured for Low Pressure Setting (LP). Select jumper 1 (JW1-LP Norm Open) for choosing between low pressure input normally opened or closed. To configure for normally closed operation, do not clip the jumper. To configure for normally open operation, clip the jumper.

D Control DIP Switches — The D Control has 2 DIP switch blocks. Each DIP switch block has 8 switches and is labeled either S1 or S2 on the circuit board. See Fig. 11 and 12.

DIP SWITCH BLOCK 1 (S1) — This set of switches offers the following options for D Control configuration:

Performance Monitor (PM) — Set switch 1 to enable or disable performance monitor. To enable the PM, set the switch to ON. To disable the PM, set the switch to OFF.

Compressor Relay Staging Operation — Switch 2 will enable or disable compressor relay staging operation. The compressor relay can be set to turn on with stage 1 or stage 2 call from the thermostat. This setting is used with dual stage units (units with 2 compressors and 2 D controls) or in master/slave applications. In master/slave applications, each compressor and fan will stage according to its switch 2 setting. If switch is set to stage 2, the compressor will have a 3-second delay before energizing during stage 2 demand.

NOTE: If DIP switch is set for stage 2, the alarm relay will not cycle during Test mode.

Heating/Cooling Thermostat Type — Switch 3 provides selection of thermostat type. Heat pump or heat/cool thermostats can be selected. Select OFF for heat/cool thermostats. When in heat/cool mode, Y1 is used for cooling stage 1, Y2 is used for cooling stage 2, W1 is used for heating stage 1 and O/W2 is used for heating stage 2. Select ON for heat pump applications. In heat pump mode, Y1 used is for compressor stage 1, Y2 is used for compressor stage 2, W1 is used for heating stage 3 or emergency heat, and O/W2 is used for RV (heating or cooling) depending upon switch 4 setting.

O/B Thermostat Type — Switch 4 provides selection for heat pump O/B thermostats. O is cooling output. B is heating output. Select ON for heat pumps with O output. Select OFF for heat pumps with B output.

Dehumidification Fan Mode — Switch 5 provides selection of normal or dehumidification fan mode. Select OFF for dehumidification mode. The fan speed relay will remain OFF during cooling stage 2. Select ON for normal mode. The fan speed relay will turn on during cooling stage 2 in normal mode.

Switch 6 — Not used.

Boilerless Operation — Switch 7 provides selection of boilerless operation and works in conjunction with switch 8. In boilerless operation mode, only the compressor is used for heating when FP1 is above the boilerless changeover temperature set by switch 8 below. Select ON for normal operation or select OFF for boilerless operation.

Boilerless Changeover Temperature — Switch 8 on S1 provides selection of boilerless changeover temperature set point. Select OFF for set point of 10°C or select ON for set point of 4.4°C .

If switch 8 is set for 10°C , then the compressor will be used for heating as long as the FP1 is above 10°C . The compressor will not be used for heating when the FP1 is below 10°C and the compressor will operate in emergency heat mode, staging on EH1 and EH2 to provide heat. If a thermal switch is being used instead of the FP1 thermistor, only the compressor will be used for heating mode when the FP1 terminals are closed. If the FP1 terminals are open, the compressor is not used and the control goes into emergency heat mode.

DIP SWITCH BLOCK 2 (S2) — This set of DIP switches is used to configure accessory relay options. See Fig. 11 and 12.

Switches 1 to 3 — These DIP switches provide selection of Accessory 1 relay options. See Table 5 for DIP switch combinations.

Switches 4 to 6 — These DIP switches provide selection of Accessory 2 relay options. See Table 6 for DIP switch combinations.

**Table 5 — DIP Switch Block S2 —
Accessory 1 Relay Options**

ACCESSORY 1 RELAY OPTIONS	DIP SWITCH POSITION		
	1	2	3
Cycle with Fan	On	On	On
Digital NSB	Off	On	On
Water Valve — Slow Opening	On	Off	On
OAD	On	On	Off

LEGEND

NSB — Night Setback
OAD — Outdoor-Air Damper

NOTE: All other DIP switch combinations are invalid.

**Table 6 — DIP Switch Block S2 —
Accessory 2 Relay Options**

ACCESSORY 2 RELAY OPTIONS	DIP SWITCH POSITION		
	4	5	6
Cycle with Fan	On	On	On
Digital NSB	Off	On	On
Water Valve — Slow Opening	On	Off	On
OAD	On	On	Off

LEGEND

NSB — Night Setback
OAD — Outdoor-Air Damper

NOTE: All other switch combinations are invalid.

Auto Dehumidification Mode or High Fan Mode — Switch 7 provides selection of auto dehumidification fan mode or high fan mode. In auto dehumidification fan mode the fan speed relay will remain off during cooling stage 2 if terminal H is active. In high fan mode, the fan enable and fan speed relays will turn on when terminal H is active. Set the switch to ON for auto dehumidification fan mode or to OFF for high fan mode.

Switch 8 — Not used.

D Control Accessory Relay Configurations —

The following accessory relay settings are applicable for both D controls only:

CYCLE WITH FAN — In this configuration, the relay will be ON any time the Fan Enable relay is on.

CYCLE WITH COMPRESSOR — In this configuration, the relay will be ON any time the Compressor relay is on.

DIGITAL NIGHT SET BACK (NSB) — In this configuration, the relay will be ON if the NSB input is connected to ground C.

NOTE: If there are no relays configured for digital NSB, then the NSB and OVR inputs are automatically configured for mechanical operation.

MECHANICAL NIGHT SET BACK — When NSB input is connected to ground C, all thermostat inputs are ignored. A thermostat set back heating call will then be connected to the OVR input. If OVR input becomes active, then the D control will enter Night Low Limit (NLL) staged heating mode. The NLL staged heating mode will then provide heating during the NSB period.

Water Valve (Slow Opening) — If relay is configured for Water Valve (slow opening), the relay will start 60 seconds prior to starting compressor relay.

Outdoor-Air Damper (OAD) — If relay is configured for OAD, the relay will normally be ON any time the Fan Enable relay is energized. The relay will not start for 30 minutes following a return to normal mode from NSB, when NSB is no longer connected to ground C. After 30 minutes, the relay will start if the Fan Enable is set to ON.

⚠ CAUTION

To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless anti-freeze is added to system water. Condenser coils never fully drain by themselves and will freeze unless winterized with antifreeze.

START-UP

Use the procedure outlined below to initiate proper unit start-up.

NOTE: This equipment is designed for indoor installation only.

Operating Limits

ENVIRONMENT — This equipment is designed for indoor installation ONLY. Extreme variations in temperature, humidity and corrosive water or air will adversely affect the unit performance, reliability and service life.

POWER SUPPLY — A voltage variation of $\pm 10\%$ of nameplate utilization voltage is acceptable.

UNIT STARTING CONDITIONS — Depending on the model, units start and operate in an ambient temperature of 7.2 C with entering air temperature at 4.4 C or 10 C, entering water temperature at -6.7 C or 10 C and with both air and water at the flow rates used.

NOTE: These operating limits are not normal or continuous operating conditions. Assume that such a start-up is for the purpose of bringing the building space up to occupancy temperature. See Table 7 for operating limits.

⚠ WARNING

When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with the energized equipment.

1. Restore power to system.
2. Turn thermostat fan position to ON. Blower should start.
3. Balance airflow at registers.
4. Adjust all valves to the full open position and turn on the line power to all heat pump units.
5. Operate unit in the cooling cycle. Refer to Table 7 for unit operating limits.

NOTE: Three factors determine the operating limits of a unit: (1) entering air temperature, (2) water temperature and (3) ambient temperature. Whenever any of these factors are at a minimum or maximum level, the other two factors must be at a normal level to ensure proper unit operation. See Table 7.

Table 7 — Operating Limits — 50RHE Units

AIR LIMITS	COOLING (C)	HEATING (C)
Min. Ambient Air	7.2	7.2
Rated Ambient Air	26.7	21.1
Max. Ambient Air	37.8	29.4
Min. Entering Air	10	4.4
Rated Entering Air db/wb	27/19	20/15
Max. Entering Air db/wb	43.3/28.3	27
WATER LIMITS		
Min. Entering Water	-1.1	-6.7
Normal Entering Water	10 to 32	-1.1 to 15.6

LEGEND

db — Dry Bulb
wb — Wet Bulb

NOTE: Value in heating column is dry bulb only. Any wet bulb reading is acceptable.

Scroll Compressor Rotation — It is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gages to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start-up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Turn off power to the unit. Install disconnect tag.
2. Reverse any two of the unit power leads.
3. Reapply power to the unit and verify pressures are correct.

The suction and discharge pressure levels should now move to their normal start-up levels.

When the compressor is rotating in the wrong direction, the unit makes more noise and does not provide cooling.

After a few minutes of reverse operation, the scroll compressor internal overload protection will open, thus activating the unit lockout. This requires a manual reset. To reset, turn the thermostat on and then off.

NOTE: There is a 5-minute time delay before the compressor will start.

Unit Start-Up Cooling Mode

1. Adjust the unit thermostat to the warmest position. Slowly reduce the thermostat position until the compressor activates.
2. Check for cool air delivery at unit grille a few minutes after the unit has begun to operate.
3. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using P/T plugs. See Table 8. Check the elevation and cleanliness of the condensate lines; any dripping could be a sign of a blocked line. Be sure the condensate trap includes a water seal.
4. Check the temperature of both supply and discharge water. Compare to Table 9. If temperature is within range, proceed. If temperature is outside the range, check the cooling refrigerant pressures in Table 9.
5. Check air temperature drop across the coil when compressor is operating. Air temperature drop should be between 8.3 and 13.9.

Table 8 — Water Temperature Change Through Heat Exchanger

WATER FLOW RATE (l/s)	COOLING RISE (C)		HEATING DROP (C)	
	Min	Max	Min	Max
For Closed Loop: Ground Source or Cooling/Boiler Systems at 0.054 l/s per kW	5	6.7	2.2	4.4
For Open Loop: Ground Water Systems 0.027 l/s per kW	11.1	14.4	5.6	9.4

Unit Start-Up Heating Mode

NOTE: Operate the unit in heating cycle after checking the cooling cycle. Allow five minutes between tests for the pressure or reversing valve to equalize.

1. Turn thermostat to lowest setting and set thermostat switch to HEAT position.
2. Slowly turn the thermostat to a higher temperature until the compressor activates.
3. Check for warm air delivery at the unit grille within a few minutes after the unit has begun to operate.
4. Check the temperature of both supply and discharge water. Compare to Table 9. If temperature is within range, proceed. If temperature is outside the range, check the heating refrigerant pressures in Table 9.
5. Once the unit has begun to run, check for warm air delivery at the unit grille.
6. Check air temperature rise across the coil when compressor is operating. Air temperature rise should be between 11.1 and 16.7 C after 15 minutes at load.
7. Check for vibration, noise and water leaks.

Flow Regulation — Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built into the valve. By measuring the pressure drop through the unit heat exchanger, the flow rate can be determined. See Table 10. Adjust the water control valve until the flow of .027 to .054 L/s per kW cooling is achieved. Since the pressure constantly varies, two pressure gages may be needed in some applications.

An alternative method is to install a flow control device. These devices are typically an orifice of plastic material designed to allow a specified flow rate that are mounted on the outlet of the water control valve. Occasionally these valves produce a velocity noise that can be reduced by applying some back pressure. To accomplish this, slightly close the leaving isolation valve of the well water setup.

WARNING

To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position before flushing system.

Table 9 — Typical Unit Operating Pressures and Temperatures

ENTERING WATER TEMP (C) (EWT)	WATER FLOW (l/s per kW)	COOLING						HEATING					
		Suction Pressure (kPa)	Discharge Pressure (kPa)	Super- heat (C)	Sub- cooling (C)	Water Temp Rise (C)	Air Temp Drop (C) DB	Suction Pressure (kPa)	Discharge Pressure (kPa)	Super- heat (C)	Sub- cooling (C)	Water Temp Drop (C) DB	Air Temp Rise (C)
-1	0.027	225-254	269-314	14-22	7-11	12-13	12-14	102-117	499-556	7- 9	1-2	4-5	8-11
	0.041	222-251	239-284	14-22	6-10	7- 9	12-14	111-129	514-571	7- 9	1-2	3-4	9-12
	0.054	219-248	209-254	14-22	6- 9	3- 6	12-14	120-138	529-586	7- 9	1-2	2-3	9-12
10	0.027	225-254	374-463	7-11	6-10	11-13	11-14	150-179	538-628	6- 9	1-3	6-7	13-16
	0.041	222-251	359-425	7-11	5- 9	7- 8	11-14	158-185	553-643	6- 9	1-3	4-5	13-17
	0.054	219-248	344-413	7-11	4- 8	4- 7	11-14	164-194	568-658	6- 9	1-3	3-4	14-17
21	0.027	225-254	535-592	5- 9	4- 8	11-12	11-13	212-245	613-688	8-11	1-3	8-9	16-19
	0.041	222-251	502-556	5- 9	4- 7	7- 9	11-13	218-254	628-712	8-11	1-3	5-6	17-21
	0.054	219-248	472-523	5- 9	4- 7	4- 7	11-13	227-263	643-724	8-11	1-3	3-4	17-21
32	0.027	225-254	685-750	5- 9	4- 8	10-12	9-13	254-284	658-777	10-16	1-3	8-9	18-22
	0.041	222-251	652-721	5- 9	4- 7	6- 8	9-13	269-299	673-792	10-16	1-3	6-7	18-23
	0.054	219-248	622-688	5- 9	4- 7	3- 6	9-13	284-314	688-807	10-16	1-3	4-5	19-23
43	0.027	231-260	837-957	4- 8	6-14	9-11	8-11						
	0.041	228-257	807-927	4- 8	6-13	5- 7	8-11						
	0.054	225-254	777-897	4- 8	6-12	3- 6	8-11						

LEGEND

DB — Dry Bulb
EAT — Entering Air Temperature

NOTES:

1. Based on nominal 54 L/s per kW airflow and 21° C EAT heating and 26.7/ 194° C EAT cooling.
2. Cooling air and water numbers can vary greatly with changes in humidity.
3. Subcooling is based upon the head pressure at compressor service port.

Table 10 — 50RHE Coaxial Water Pressure Drop

UNIT 50RHE	L/S	PRESSURE DROP (kPa)			
		0° C	10° C	20° C	30° C
006	0.047	6.0	5.4	5.1	4.8
	0.071	8.4	7.8	7.2	6.9
	0.095	14.1	13.2	12.0	11.7
009	0.071	8.1	7.5	6.9	6.6
	0.107	12.0	11.1	10.5	9.9
	0.139	23.9	22.4	20.9	20.0
012	0.095	19.1	17.9	16.7	16.1
	0.145	41.3	38.9	36.2	34.7
	0.189	66.1	61.9	57.7	55.0
015	0.114	16.7	15.5	14.7	14.1
	0.164	32.6	30.5	28.7	27.2
	0.221	55.9	52.3	48.7	46.3
019	0.142	12.9	12.0	11.1	10.8
	0.215	23.0	21.5	20.3	19.1
	0.284	45.4	42.5	39.8	37.7
024	0.189	13.8	12.6	11.7	11.4
	0.284	28.7	26.9	25.1	23.9
	0.379	47.8	44.9	41.9	39.8
030	0.237	9.9	9.0	8.4	8.1
	0.347	17.0	15.8	14.7	14.1
	0.473	26.9	25.4	23.6	22.4
036	0.284	7.8	7.2	6.9	6.6
	0.426	15.0	13.8	12.9	12.3
	0.568	23.9	22.4	20.9	20.0
042	0.331	9.9	9.3	8.7	8.4
	0.498	19.7	18.5	17.0	16.4
	0.663	31.1	29.3	27.5	26.0
048	0.379	14.1	13.2	12.3	11.7
	0.568	26.9	25.4	23.6	22.4
	0.757	44.0	41.0	38.3	36.5
060	0.473	33.5	31.4	29.3	27.8
	0.713	58.3	54.4	50.8	48.4
	0.947	88.5	82.8	77.1	73.3

Flushing — Once the piping is complete, units require final purging and loop charging. A flush cart pump of at least 1.5 hp (1.12 kW) is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop. Flush the loop in both directions with a high volume of water at a high velocity. Follow the steps below to properly flush the loop:

1. Verify power is off.
2. Fill loop with water from hose through flush cart before using flush cart pump to ensure an even fill. Do not allow the water level in the flush cart tank to drop below the pump inlet line to prevent air from filling the line.

3. Maintain a fluid level in the tank above the return tee to avoid air entering back into the fluid.
4. Shutting off the return valve that connects into the flush cart reservoir will allow 345 kPa surges to help purge air pockets. This maintains the pump at 345 kPa.
5. To purge, keep the pump at 345 kPa until maximum pumping pressure is reached.
6. Open the return valve to send a pressure surge through the loop to purge any air pockets in the piping system.
7. A noticeable drop in fluid level will be seen in the flush cart tank. This is the only indication of air in the loop.

NOTE: If air is purged from the system while using a 254 mm PVC flush tank, the level drop will only be 25 to 51 mm since liquids are incompressible. If the level drops more than this, flushing should continue since air is still being compressed in the loop. If level is less than 25 to 51 mm, reverse the flow.

8. Repeat this procedure until all air is purged.
9. Restore power.

Antifreeze may be added before, during or after the flushing process. However, depending on when it is added in the process, it can be wasted. Refer to the Antifreeze section for more detail.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the warmer months. This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for several minutes to condition the loop to a homogenous temperature.

When complete, perform a final flush and pressurize the loop to a static pressure of 275 to 345 kPa for winter months or 105 to 135 kPa for summer months.

After pressurization, be sure to remove the plug from the end of the loop pump motor(s) to allow trapped air to be discharged and to ensure the motor housing has been flooded. Be sure the loop flow center provides adequate flow through the unit by checking pressure drop across the heat exchanger. Compare the results to the data in Table 10.

Antifreeze — In areas where entering loop temperatures drop below 4.4 C or where piping will be routed through areas subject to freezing, antifreeze is needed.

Alcohols and glycols are commonly used as antifreeze agents. Freeze protection should be maintained to 8.3 K below the lowest expected entering loop temperature. For example, if the lowest expected entering loop temperature is -1.1 C, the leaving loop temperature would be -5.6 to -3.9 C. Therefore, the freeze protection should be at -9.4 C (-1.1 C - 8.3 C = -9.4 C).

IMPORTANT: All alcohols should be pre-mixed and pumped from a reservoir outside of the building or introduced under water level to prevent fuming.

Calculate the total volume of fluid in the piping system. See Table 11. Use the percentage by volume in Table 12 to determine the amount of antifreeze to use. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

FREEZE PROTECTION SELECTION — The -1.1 C FP1 factory setting (water) should be used to avoid freeze damage to the unit.

Once antifreeze is selected, the JW3 jumper (FP1) should be clipped on the control to select the low temperature (antifreeze 13 F) set point to avoid nuisance faults.

Table 11 — Approximate Fluid Volume (L) per 30 m of Pipe

PIPE	DIAMETER (in.)	VOLUME (l)
Copper	1	15.5
	1.25	24.2
	1.5	34.8
Rubber Hose	1	14.7
Polyethylene	3/4 IPS SDR11	10.6
	1 IPS SDR11	17.0
	1 1/4 IPS SDR11	30.0
	1 1/2 IPS SDR11	41.2
	2 IPS SDR11	68.1
	1 1/4 IPS SCH40	31.4
	1 1/2 IPS SCH40	41.2
	2 IPS SCH40	64.3

LEGEND

IPS — Internal Pipe Size
SCH — Schedule
SDR — Standard Dimensional Ratio

NOTE: Volume of heat exchanger is approximately 3.78 liters.

Table 12 — Antifreeze Percentages by Volume

ANTIFREEZE	MINIMUM TEMPERATURE FOR FREEZE PROTECTION (C)			
	-12	-9	-7	-4
Methanol (%)	25	21	16	10
100% USP Food Grade Propylene Glycol (%)	38	30	22	15

Cooling Tower/Boiler Systems — These systems typically use a common loop temperature maintained at 15.6 to 32.2 C. Carrier recommends using a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary. The optional cupronickel heat exchanger must also be used in this case.

Ground Coupled, Closed Loop and Plateframe Heat Exchanger Well Systems — These systems allow water temperatures from -1.1 to 43.3 C. The external loop field is divided up into 51 mm polyethylene supply and return lines. Each line has valves connected in such a way that upon system start-up, each line can be isolated for flushing using only the system pumps. Locate air separation in the piping system prior to the fluid re-entering the loop field.

OPERATION

Power Up Mode — The unit will not operate until all the inputs, terminals and safety controls are checked for normal operation.

NOTE: The compressor will have a 5-minute anti-short cycle upon power up.

Units with Aquazone™ Complete C Control

STANDBY — Y and W terminals are not active in standby mode, however the O and G terminals may be active, depending on the application. The compressor will be off.

COOLING — Y and O terminals are active in Cooling mode. After power up, the first call to the compressor will initiate a 5 to 80 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

NOTE: On all subsequent compressor calls the random start delay is omitted.

HEATING STAGE 1 — Terminal Y is active in heating stage 1. After power up, the first call to the compressor will initiate a 5 to 80 second random start delay and a 5-minute anti-short cycle protection time delay. After both delays are complete, the compressor is energized.

NOTE: On all subsequent compressor calls the random start delay is omitted.

HEATING STAGE 2 — To enter Stage 2 mode, terminal W is active (Y is already active). Also, the G terminal must be active or the W terminal is disregarded. The compressor relay will remain on and EH1 is immediately turned on. EH2 will turn on after 10 minutes of continual stage 2 demand.

NOTE: EH2 will not turn on (or if on, will turn off) if FP1 temperature is greater than 7.2 C and FP2 is greater than 43.3 C.

EMERGENCY HEAT — In emergency heat mode, terminal W is active while terminal Y is not. Terminal G must be active or the W terminal is disregarded. EH1 is immediately turned on. EH2 will turn on after 5 minutes of continual emergency heat demand.

Units with Aquazone Deluxe D Control

STANDBY/FAN ONLY — The compressor will be off. The Fan Enable, Fan Speed, and reversing valve (RV) relays will be on if inputs are present. If there is a Fan 1 demand, the Fan Enable will immediately turn on. If there is a Fan 2 demand, the Fan Enable and Fan Speed will immediately turn on.

NOTE: DIP switch 5 on S1 does not have an effect upon Fan 1 and Fan 2 outputs.

HEATING STAGE 1 — In Heating Stage 1 mode, the Fan Enable and Compressor relays are turned on immediately. Once the demand is removed, the relays are turned off and the control reverts to Standby mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will operate per their associated DIP switch 2 setting on S1.

HEATING STAGE 2 — In Heating Stage 2 mode, the Fan Enable and Compressor relays are remain on. The Fan Speed relay is turned on immediately and turned off immediately once the demand is removed. The control reverts to Heating Stage 1 mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will operate per their associated DIP switch 2 setting on S1.

HEATING STAGE 3 — In Heating Stage 3 mode, the Fan Enable, Fan Speed and Compressor relays remain on. The EH1 output is turned on immediately. With continuing Heat Stage 3 demand, EH2 will turn on after 10 minutes. EH1 and EH2 are turned off immediately when the Heating Stage 3 demand is removed. The control reverts to Heating Stage 2 mode.

Output EH2 will be off if FP1 is greater than 7.2 C and FP2 (when shorted) is greater than 43.3 C during Heating Stage 3 mode. This condition will have a 30-second recognition time. Also, during Heating Stage 3 mode, EH1, EH2, Fan Enable, and Fan Speed will be ON if G input is not active.

EMERGENCY HEAT — In Emergency Heat mode, the Fan Enable and Fan Speed relays are turned on. The EH1 output is turned on immediately. With continuing Emergency Heat demand, EH2 will turn on after 5 minutes. Fan Enable and Fan Speed relays are turned off after a 60-second delay. The control reverts to Standby mode.

Output EH1, EH2, Fan Enable, and Fan Speed will be ON if the G input is not active during Emergency Heat mode.

COOLING STAGE 1 — In Cooling Stage 1 mode, the Fan Enable, compressor and RV relays are turned on immediately. If configured as stage 2 (DIP switch set to OFF) then the compressor and fan will not turn on until there is a stage 2 demand. The fan Enable and compressor relays are turned off immediately when the Cooling Stage 1 demand is removed. The control reverts to Standby mode. The RV relay remains on until there is a heating demand. If there is a master/slave or dual compressor application, all compressor relays and related functions will track with their associated DIP switch 2 on S1.

COOLING STAGE 2 — In Cooling Stage 2 mode, the Fan Enable, compressor and RV relays remain on. The Fan Speed relay is turned on immediately and turned off immediately once the Cooling Stage 2 demand is removed. The control reverts to Cooling Stage 1 mode. If there is a master/slave or dual compressor application, all compressor relays and related functions will track with their associated DIP switch 2 on S1.

NIGHT LOW LIMIT (NLL) STAGED HEATING — In NLL staged Heating mode, the override (OVR) input becomes active and is recognized as a call for heating and the control will immediately go into a Heating Stage 1 mode. With an additional 30 minutes of NLL demand, the control will go into Heating Stage 2 mode. With another additional 30 minutes of NLL demand, the control will go into Heating Stage 3 mode.

SYSTEM TEST

System testing provides the ability to check the control operation. The control enters a 20-minute Test mode by momentarily shorting the test pins (see Fig. 9-12). All time delays are reduced by a factor of 15.

Test Mode — To enter Test mode on C or D controls, cycle the power 3 times within 60 seconds. The LED (light-emitting diode) will flash a code representing the last fault when entering the Test mode. The alarm relay will also power on and off during Test mode. See Tables 13 and 14. To exit Test mode, short the terminals for 3 seconds or cycle the power 3 times within 60 seconds.

NOTE: Deluxe D Control has a flashing code and alarm relay cycling code that will both have the same numerical label. For example, flashing code 1 will have an alarm relay cycling code 1. Code 1 indicates the control has not faulted since the last power off to power on sequence.

Table 13 — C Control Current LED Status and Alarm Relay Operations

LED STATUS	DESCRIPTION OF OPERATION	ALARM RELAY
On	Normal Mode	Open
	Normal Mode with PM Warning	Cycle (closed 5 sec., Open 25 sec.)
Off	C Control is non-functional	Open
Slow Flash	Fault Retry	Open
Fast Flash	Lockout	Closed
Slow Flash	Over/Under Voltage Shutdown	Open (Closed after 15 minutes)
Flashing Code 1	Test Mode — No fault in memory	Cycling Code 1
Flashing Code 2	Test Mode — HP Fault in memory	Cycling Code 2
Flashing Code 3	Test Mode — LP Fault in memory	Cycling Code 3
Flashing Code 4	Test Mode — FP1 Fault in memory	Cycling Code 4
Flashing Code 5	Test Mode — FP2 Fault in memory	Cycling Code 5
Flashing Code 6	Test Mode — CO Fault in memory	Cycling Code 6
Flashing Code 7	Test Mode — Over/Under shutdown in memory	Cycling Code 7
Flashing Code 8	Test Mode — PM in memory	Cycling Code 8
Flashing Code 9	Test Mode — FP1/FP2 Swapped Fault in memory	Cycling Code 9

LEGEND

CO — Condensate Overflow
FP — Freeze Protection
HP — High Pressure
LED — Light-Emitting Diode
LP — Low Pressure
PM — Performance Monitor

NOTES:

1. Slow flash is 1 flash every 2 seconds.
2. Fast flash is 2 flashes every 1 second.
3. **EXAMPLE:** "Flashing Code 2" is represented by 2 fast flashes followed by a 10-second pause. This sequence will repeat continually until the fault is cleared.

Table 14 — C Control LED Code and Fault Descriptions

LED CODE	FAULT	DESCRIPTION
1	No fault in memory	There has been no fault since the last power-down to power-up sequence
2	High-Pressure Switch	HP Open Instantly
3	Low-Pressure Switch	LP open for 30 continuous seconds before or during a call (bypassed for first 60 seconds)
4	Freeze Protection Coax — FP1	FP1 below Temp limit for 30 continuous seconds (bypassed for first 60 seconds of operation)
5	Freeze Protection Air Coil — FP2	FP2 below Temp limit for 30 continuous seconds (bypassed for first 60 seconds of operation)
6	Condensate overflow	Sense overflow (grounded) for 30 continuous seconds
7 (Autoreset)	Over/Under Voltage Shutdown	"R" power supply is <19VAC or >30VAC
8	PM Warning	Performance Monitor Warning has occurred.
9	FP1 and FP2 Thermistors are swapped	FP1 temperature is higher than FP2 in heating/test mode, or FP2 temperature is higher than FP1 in cooling/test mode.

LEGEND

FP — Freeze Protection
HP — High Pressure
LED — Light-Emitting Diode
LP — Low Pressure
PM — Performance Monitor

Retry Mode — In Retry mode, the status LED will start to flash slowly to signal that the control is trying to recover from an input fault. The control will stage off the outputs and try to again satisfy the thermostat used to terminal Y. Once the thermostat input calls are satisfied, the control will continue normal operation.

NOTE: If 3 consecutive faults occur without satisfying the thermostat input call to terminal Y, the control will go into lockout mode. The last fault causing the lockout is stored in memory and can be viewed by entering Test mode.

Aquazone™ Deluxe D Control LED Indicators

— There are 3 LED indicators on the D Control:

STATUS LED — Status LED indicates the current status or mode of the D control. The Status LED light is green.

TEST LED — Test LED will be activated any time the D control is in test mode. The Test LED light is yellow.

FAULT LED — Fault LED light is red. The fault LED will always flash a code representing the last fault in memory. If there is no fault in memory, the fault LED will flash code 1 on the and appear as 1 fast flash alternating with a 10-second pause. See Table 15.

SERVICE

Perform the procedures outlined below periodically, as indicated.

IMPORTANT: When a compressor is removed from this unit, system refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, the refrigerant lines of the compressor must be sealed after it is removed.

IMPORTANT: All refrigerant discharged from this unit must be recovered without exception. Technicians must follow industry accepted guidelines and all local, state and federal statutes for the recovery and disposal of refrigerants.

IMPORTANT: To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must only be serviced by technicians which meet local, state and federal proficiency requirements.

IMPORTANT: To prevent injury or death due to electrical shock or contact with moving parts, open unit disconnect switch before servicing unit.

Filters — Filters must be clean for maximum performance. Inspect filters every month under normal operating conditions. replace when necessary.

IMPORTANT: Units should never be operated without a filter.

Water Coil — Keep all air out of the water coil. Check open loop systems to be sure the well head is not allowing air to infiltrate the water line. Always keep lines airtight.

Inspect heat exchangers regularly, and clean more frequently if the unit is located in a “dirty” environment. Keep the heat exchanger full of water at all times. Open loop systems should have an inverted P trap placed in the discharge line to keep water in the heat exchanger during off cycles. Closed loop systems must have a minimum of 105 kPa during the summer and 275 kPa during the winter.

Check P trap frequently for proper operation.

Table 15 — Aquazone™ D Control Current LED Status and Alarm Relay Operations

DESCRIPTION	STATUS LED (Green)	TEST LED (Yellow)	FAULT LED (Red)	ALARM RELAY
Normal Mode	On	Off	Flash Last Fault Code in Memory	Open
Normal Mode with PM	On	Off	Flashing Code 8	Cycle (closed 5 sec, open 25 sec, ...)
D Control is non-functional	Off	Off	Off	Open
Test Mode	—	On	Flash Last Fault Code in Memory	Cycling Appropriate Code
Night Setback	Flashing Code 2	—	Flash Last Fault Code in Memory	—
ESD	Flashing Code 3	—	Flash Last Fault Code in Memory	—
Invalid T-stat Inputs	Flashing Code 4	—	Flash Last Fault Code in Memory	—
No Fault in Memory	On	Off	Flashing Code 1	Open
HP Fault	Slow Flash	Off	Flashing Code 2	Open
LP Fault	Slow Flash	Off	Flashing Code 3	Open
FP1 Fault	Slow Flash	Off	Flashing Code 4	Open
FP2 Fault	Slow Flash	Off	Flashing Code 5	Open
CO Fault	Slow Flash	Off	Flashing Code 6	Open
Over/Under Voltage	Slow Flash	Off	Flashing Code 7	Open (closed after 15 minutes)
HP Lockout	Fast Flash	Off	Flashing Code 2	Closed
LP Lockout	Fast Flash	Off	Flashing Code 3	Closed
FP1 Lockout	Fast Flash	Off	Flashing Code 4	Closed
FP2 Lockout	Fast Flash	Off	Flashing Code 5	Closed
CO Lockout	Fast Flash	Off	Flashing Code 6	Closed

LEGEND

CO — Condensate Overflow
ESD — Emergency Shutdown
FP — Freeze Protection
HP — High Pressure
LP — Low Pressure
PM — Performance Monitor

NOTES:

1. If there is no fault in memory, the Fault LED will flash code 1.
2. Codes will be displayed with a 10-second Fault LED pause.
3. Slow flash is 1 flash every 2 seconds.
4. Fast flash is 2 flashes every 1 second.
5. **EXAMPLE:** “Flashing Code 2” is represented by 2 fast flashes followed by a 10-second pause. This sequence will repeat continually until the fault is cleared.

⚠ CAUTION

To avoid fouled machinery and extensive unit clean-up, **DO NOT** operate units without filters in place. **DO NOT** use equipment as a temporary heat source during construction.

Condensate Drain Pans — Check condensate drain pans for algae growth twice a year. If algae growth is apparent, consult a water treatment specialist for proper chemical treatment. Applying an algicide every three months will typically eliminate algae problems in most locations.

Refrigerant System — Verify air and water flow rates are at proper levels before servicing. To maintain sealed circuitry integrity, do not install service gauges unless unit operation appears abnormal.

Check to see that unit is within the superheat and subcooling temperature ranges shown in Table 16. If the unit is not within these ranges, recover and reweigh in refrigerant charge.

Condensate Drain Cleaning — Clean the drain line and unit drain pan at the start of each cooling season. Check flow by pouring water into drain. Be sure trap is filled to maintain an air seal.

Air Coil Cleaning — Remove dirt and debris from evaporator coil as required by condition of the coil. Clean coil with a stiff brush, vacuum cleaner, or compressed air. Use a fin comb of the correct tooth spacing when straightening mashed or bent coil fins.

Condenser Cleaning — Water-cooled condensers may require cleaning of scale (water deposits) due to improperly maintained closed-loop water systems. Sludge build-up may need to be cleaned in an open water tower system due to induced contaminants.

Local water conditions may cause excessive fouling or pitting of tubes. Condenser tubes should therefore be cleaned at least once a year, or more often if the water is contaminated.

Proper water treatment can minimize tube fouling and pitting. If such conditions are anticipated, water treatment analysis is recommended. Refer to the Carrier System Design Manual, Part 5, for general water conditioning information.

⚠ CAUTION

Follow all safety codes. Wear safety glasses and rubber gloves when using inhibited hydrochloric acid solution. Observe and follow acid manufacturer's instructions.

Clean condensers with an inhibited hydrochloric acid solution. The acid can stain hands and clothing, damage concrete, and, without inhibitor, damage steel. Cover surroundings to guard against splashing. Vapors from vent pipe are not harmful, but take care to prevent liquid from being carried over by the gases.

Warm solution acts faster, but cold solution is just as effective if applied for a longer period.

GRAVITY FLOW METHOD — Do not add solution faster than vent can exhaust the generated gases.

When condenser is full, allow solution to remain overnight, then drain condenser and flush with clean water. Follow acid manufacturer's instructions. See Fig. 18.

FORCED CIRCULATION METHOD — Fully open vent pipe when filling condenser. The vent may be closed when condenser is full and pump is operating. See Fig. 19.

Regulate flow to condenser with a supply line valve. If pump is a nonoverloading type, the valve may be fully closed while pump is running.

For average scale deposit, allow solution to remain in condenser overnight. For heavy scale deposit, allow 24 hours. Drain condenser and flush with clean water. Follow acid manufacturer's instructions.

Checking System Charge — Units are shipped with full operating charge. If recharging is necessary:

1. Insert thermometer bulb in insulating rubber sleeve on liquid line near filter drier. Use a digital thermometer for all temperature measurements. **DO NOT** use a mercury or dial-type thermometer.
2. Connect pressure gage to discharge line near compressor.
3. After unit conditions have stabilized, read head pressure on discharge line gage.

NOTE: Operate unit a minimum of 15 minutes before checking charge.

4. From standard field-supplied Pressure-Temperature chart for R-407C, find equivalent bubble point temperature.

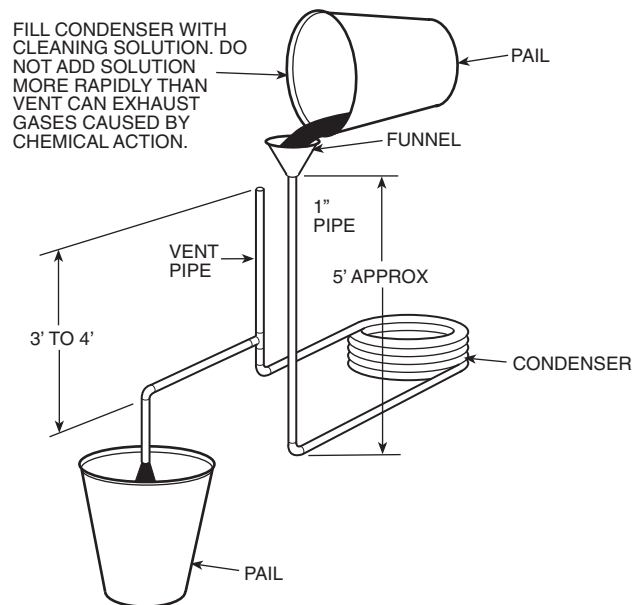


Fig. 18 — Gravity Flow Method

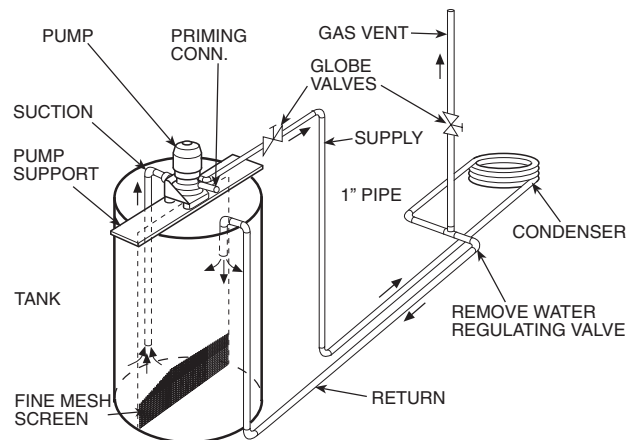


Fig. 19 — Forced Circulation Method

- Read liquid line temperature on thermometer; then subtract from bubble point temperature. The difference equals subcooling temperature.
- Compare the subcooling temperature with the normal temperature listed in Table 9. If the measured liquid line temperature does not agree with the required liquid line temperature, ADD refrigerant to raise the temperature or REMOVE refrigerant (using standard practices) to lower the temperature (allow a tolerance of $\pm 1.7^\circ \text{C}$).

Refrigerant Charging

⚠ WARNING

To prevent personal injury, wear safety glasses and gloves when handling refrigerant. Do not overcharge system — this can cause compressor flooding.

NOTE: Do not vent or depressurize unit refrigerant to atmosphere. Remove and reclaim refrigerant following accepted practices.

Air Coil Fan Motor Removal

⚠ CAUTION

Before attempting to remove fan motors or motor mounts, place a piece of plywood over evaporator coils to prevent coil damage.

Disconnect motor power wires from motor terminals before motor is removed from unit.

- Shut off unit main power supply.
- Loosen bolts on mounting bracket so that fan belt can be removed.
- Loosen and remove the 2 motor mounting bracket bolts on left side of bracket.
- Slide motor/bracket assembly to extreme right and lift out through space between fan scroll and side frame. Rest

motor on a high platform such as a step ladder. Do not allow motor to hang by its power wires.

TROUBLESHOOTING (Fig. 20 and 21, and Table 16)

When troubleshooting problems with a WSHP, consider the following.

Thermistor — A thermistor may be required for single-phase units where starting the unit is a problem due to low voltage. See Fig. 20 for thermistor nominal resistance.

Control Sensors — The control system employs 2 nominal 10,000 ohm thermistors (FP1 and FP2) that are used for freeze protection. Be sure FP1 is located in the discharge fluid and FP2 is located in the air discharge. See Fig. 21.

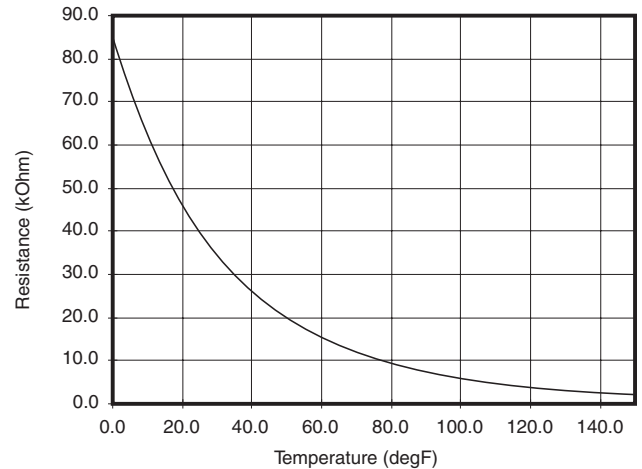


Fig. 20 — Thermistor Nominal Resistance

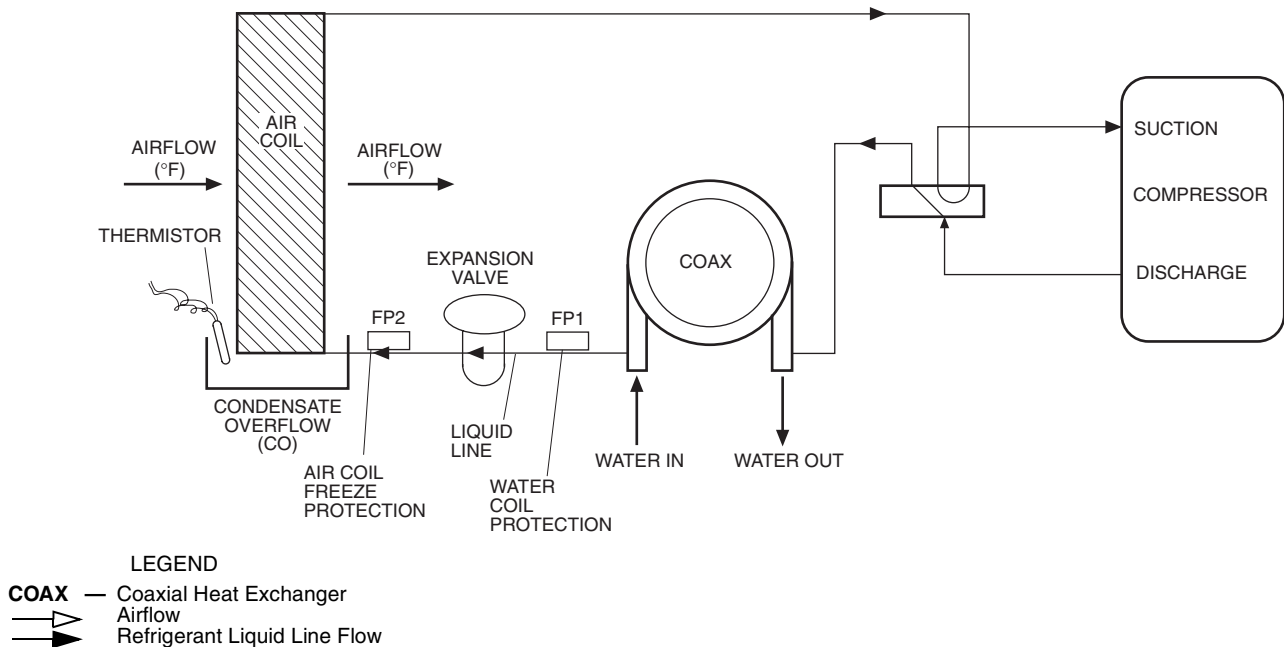


Fig. 21 — FP1 and FP2 Thermistor Location

Table 16 — Troubleshooting

FAULT	HEATING	COOLING	POSSIBLE CAUSE	SOLUTION
Main Power Problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24 vac between R and C on controller.
				Check primary/secondary voltage on transformer.
HP Fault — Code 2 High Pressure		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
		X	Water temperature out of range in cooling	Check water flow adjust to proper flow rate.
				Bring water temperature within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty air coil — construction dust etc.
				External static too high. Check Table 4.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition Table 9.
	X	X	Bad HP switch	Check switch continuity and operation. Replace.
LP/LOC Fault — Code 3 Low Pressure/Loss of Charge	X	X	Insufficient charge	Check for refrigerant leaks.
	X		Compressor pump down at start-up	Check charge and start-up water flow.
FP1 Fault — Code 4 Water Freeze Protection	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace.
				Check water flow adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper freeze protect setting (–1.1 C vs –12.2 C)	Clip JW2 jumper for antifreeze (–12.2 C) use.
	X		Water temperature out of range	Bring water temperature within design parameters.
FP2 Fault — Code 5 Air Coil Freeze Protection	X	X	Bad thermistor	Check temperature and impedance correlation.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				External static too high. Check Table 4.
		X	Air temperature out of range	Too much cold vent air. Bring entering air temperature within design parameters.
		X	Improper freeze protect setting (–1.1 C vs –12.2 C)	Normal airside applications will require –1.1 C only.
Condensate Fault — Code 6	X	X	Bad thermistor	Check temperature and impedance correlation.
	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
Over/Under Voltage — Code 7 (Auto Resetting)				Poor venting. Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
	X	X	Under voltage	Check power supply and 24 vac voltage before and during operation.
				Check power supply wire size.
Performance Monitor — Code 8				Check compressor starting.
				Check 24 vac and unit transformer tap for correct power supply voltage.
	X	X	Over voltage	Check power supply voltage and 24 vac before and during operation.
				Check 24 vac and unit transformer tap for correct power supply voltage.
FP1 and FP2 Thermistors — Code 9	X		Heating mode FP2> 51.7 C	Check for poor airflow or overcharged unit.
		X	Cooling mode FP1> 51.7 C OR FP2< 4.4 C	Check for poor water flow or airflow.
	X		FP1 temperature is higher than FP2 temperature.	Swap FP1 and FP2 thermistors.
		X	FP2 temperature is higher than FP1 temperature.	Swap FP1 and FP2 thermistors.
No Fault Code Shown	X	X	No compressor operation	See scroll compressor rotation section.
	X	X	Compressor overload	Check and replace if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in 'Test Mode'	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace if necessary.
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check Y and W wiring at heat pump. Jumper Y and R for compressor operation in Test mode.

LEGEND

RV — Reversing Valve

Table 16 — Troubleshooting (cont)

FAULT	HEATING	COOLING	POSSIBLE CAUSE	SOLUTION
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation.
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for line voltage across BR contacts. Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check Y and W wiring at heat pump. Jumper Y and R for compressor operation in Test mode.
Unit Does Not Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24 vac on RV coil and at control. If RV is stuck, run high pressure up by reducing water flow and while operating, engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'Click'.
Insufficient Capacity/ Not Cooling or Heating Properly	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high. Check blower Table 4.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high. Check blower Table 4.
	X	X	Leaky ductwork	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling Table 9.
	X	X	Restricted metering device	Check superheat and subcooling Table 9. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind thermostat.
	X	X	Unit undersized	Recheck loads and sizing check sensible cooling load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or cold	Check load, loop sizing, loop backfill, ground moisture.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high. Check blower Table 4.
High Head Pressure		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting. Check water flow; adjust to proper flow rate. See Table 8.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Reweigh in charge.
	X	X	Non-condensables in system	Vacuum system and reweigh in charge.
	X	X	Restricted metering device	Check superheat and subcooling per Table 9. Replace.
	X		Reduced water flow in heating	Check pump operation or water valve operation/setting. Plugged strainer or filter. Clean or replace. Check water flow adjust to proper flow rate.
Low Suction Pressure	X		Water temperature out of range	Bring water temperature within design parameters.
		X	Reduced airflow in cooling	Check for dirty air filter and clean or replace. Check fan motor operation and airflow restrictions. External static too high. Check blower Table 4.
		X	Air temperature out of range	Too much cold vent air. Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
	X		Too high airflow	Check blower Table 4.
Low Discharge Air Temperature in Heating	X		Poor performance	See 'Insufficient Capacity'.
		X	Too high airflow	Check blower Table 4.
High Humidity		X	Unit oversized	Recheck loads and sizing check sensible cooling load and heat pump capacity.

LEGEND

RV — Reversing Valve

**50RHE R-407C UNIT
START-UP CHECKLIST**

CUSTOMER: _____ JOB NAME: _____
MODEL NO.: _____ SERIAL NO.: _____ DATE: _____

I. PRE-START-UP

DOES THE UNIT VOLTAGE CORRESPOND WITH THE SUPPLY VOLTAGE AVAILABLE? (Y/N) _____

HAVE THE POWER AND CONTROL WIRING CONNECTIONS BEEN MADE AND TERMINALS TIGHT? (Y/N) _____

HAVE WATER CONNECTIONS BEEN MADE AND IS FLUID AVAILABLE AT HEAT EXCHANGER? (Y/N) _____

HAS PUMP BEEN TURNED ON AND ARE ISOLATION VALVES OPEN? (Y/N) _____

HAS CONDENSATE CONNECTION BEEN MADE AND IS A TRAP INSTALLED? (Y/N) _____

IS AN AIR FILTER INSTALLED? (Y/N) _____

II. START-UP

IS FAN OPERATING WHEN COMPRESSOR OPERATES? (Y/N) _____

IF 3-PHASE SCROLL COMPRESSOR IS PRESENT, VERIFY PROPER ROTATION PER INSTRUCTIONS. (Y/N) _____

UNIT VOLTAGE — COOLING OPERATION

PHASE AB VOLTS _____	PHASE BC VOLTS _____ (if 3 phase)	PHASE CA VOLTS _____ (if 3 phase)
PHASE AB AMPS _____	PHASE BC AMPS _____ (if 3 phase)	PHASE CA AMPS _____ (if 3 phase)

CONTROL VOLTAGE

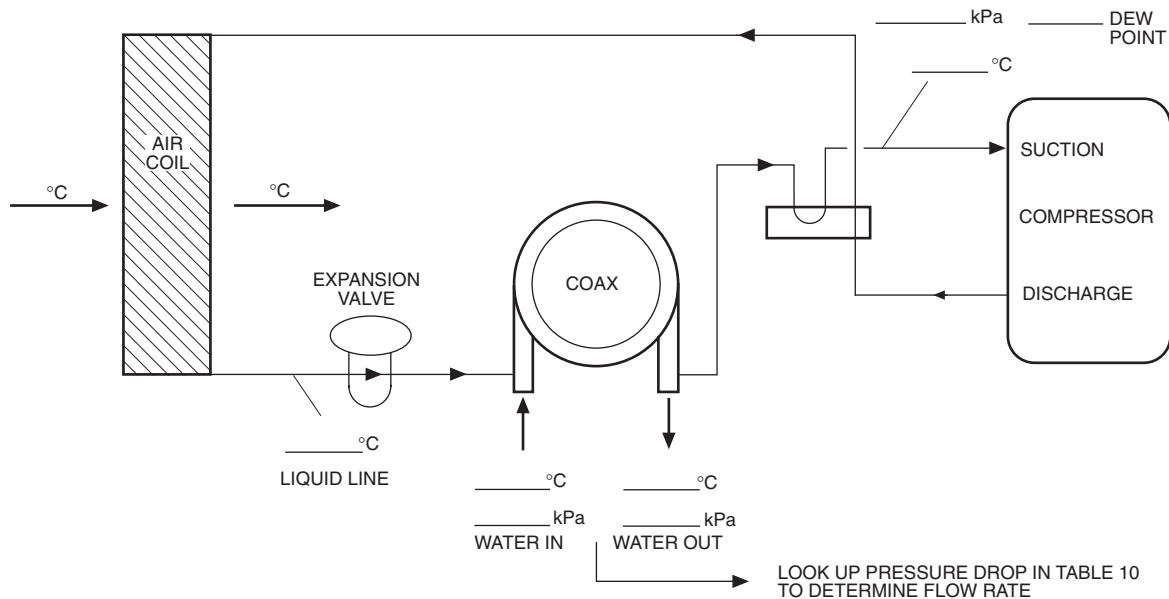
IS CONTROL VOLTAGE ABOVE 21.6 VOLTS? (Y/N) _____.
IF NOT, CHECK FOR PROPER TRANSFORMER CONNECTION.

TEMPERATURES

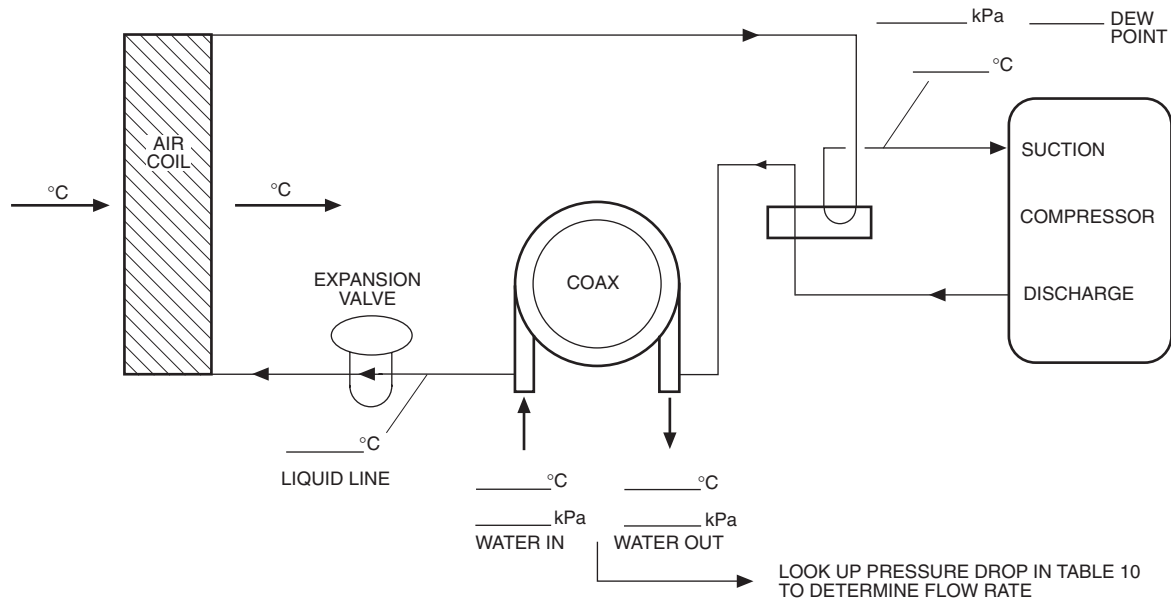
FILL IN THE ANALYSIS CHART ATTACHED.

COAXIAL HEAT EXCHANGER	COOLING CYCLE:					
	FLUID IN	_____ C	FLUID OUT	_____ C	_____ kPa	_____ L/S
AIR COIL	HEATING CYCLE:					
	FLUID IN	_____ C	FLUID OUT	_____ C	_____ kPa	_____ L/S
	COOLING CYCLE:					
	AIR IN	_____ C	AIR OUT	_____ C		
	HEATING CYCLE:					
	AIR IN	_____ C	AIR OUT	_____ C		

HEATING CYCLE ANALYSIS



COOLING CYCLE ANALYSIS



HEAT OF EXTRACTION (ABSORPTION) OR HEAT OF REJECTION =

$$\text{FLOW RATE (L/S)} \times \text{TEMP. DIFF. (DEG. C)} \times \text{FLUID FACTOR}^* = \text{(kW)}$$

$$\text{SUPERHEAT} = \text{SUCTION TEMPERATURE} - \text{SUCTION DEW POINT TEMPERATURE}$$

$$= \text{(DEG C)}$$

$$\text{SUBCOOLING} = \text{DISCHARGE BUBBLE POINT TEMPERATURE} - \text{LIQUID LINE TEMPERATURE}$$

$$= \text{(DEG C)}$$

*Use 4.16 for water, 4.03 for antifreeze.